RAND

The Defense System Cost Performance Database

Cost Growth Analysis Using Selected Acquisition Reports

J. M. Jarvaise, J. A. Drezner, D. Norton

National Defense Research Institute

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PREFACE

The problem of cost growth in weapon system development—the difference between estimated and actual costs—has been a recurring theme in acquisition reform for the last several decades. Despite its high visibility, there has been little systematic and consistent analysis of cost growth patterns and trends, and the factors that affect cost growth.

To facilitate such analyses, RAND has developed the Defense Systems Cost Performance Database (DSCPD). This database includes cost growth data derived from information in Selected Acquisition Reports (SARs), as well as a range of potential explanatory variables that include cost, schedule, and categorical information. The DSCPD has supported a number of RAND studies sponsored by both the U.S. Air Force and the Office of the Director, Program Analysis and Evaluation (OD (PA&E)).

With the encouragement of our sponsor in OD (PA&E), RAND is making the DSCPD available to interested analysts concerned with weapon system acquisition issues.

This report, documenting the contents of the DSCPD, was prepared for the Office of the Director, Program Analysis and Evaluation. The work was performed in the Forces and Resources Policy Center of RAND's National Defense Research Institute, a federally funded research and development center sponsored by the Office of the Secretary of Defense, the Joint Staff, and the defense agencies.

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Cost growth in weapon system acquisition is a pervasive problem with a long history. Though the issue has been studied extensively over the last several decades, the results of these studies appear not to have translated into policy changes that have had a measurable impact on cost growth. To facilitate long-term, comprehensive, and consistent analysis of weapon system cost growth, RAND has developed the Defense Systems Cost Performance Database (DSCPD).

This report documents the DSCPD. Our objective is to describe the database in enough detail to facilitate its use by other analysts. Accordingly, we discuss data sources, database structure, adjustments and normalization procedures used in the database, and caveats and limitations on its use. We hope that extensive use of the database by analysts both in and out of government will improve understanding of the problem of cost growth in weapon systems and of our ability to control it.

The DSCPD is based on information from Selected Acquisition Reports (SARs). It contains cost growth factors (CGFs) for the following cost categories: total program, procurement adjusted for quantity changes, procurement unadjusted for quantity changes, and research and development (R&D). It also contains a set of potential explanatory variables that may be used as a starting point to facilitate analysis of the factors affecting cost growth. Potential explanatory variables consist of cost, schedule, and categorical information such as service, weapon system type, and development strategy. Cost variables include development costs, unadjusted procurement costs, adjusted procurement costs, military construction costs, total program costs, and the ratio of development costs to procurement expenditures. Schedule information includes specific milestone events, and intervals and schedule slip measures derived from those milestones. Categorical information—including lead service, contractor, and prototyping and modification designations—can be used as explanatory variables or to divide the database into desired subsets.

The DSCPD is composed of three types of spreadsheet files:

1. Program files are the basic information source and are specific to each weapon system program. They are the data source files and contain information used by the two types of analysis files. They contain the cost and quantity information, and normalization models, used to calculate adjusted cost growth factors.
2. The Point Estimate Analysis (PEA) file contains the categorical and schedule data, as well as the latest cost growth data drawn from the program files. This file may be used to calculate

descriptive statistics of the most current cost growth data and perform analyses of potential factors affecting that cost growth.

3. Time-trend files track the cost growth performance of weapon systems over time and draw their information from the program files.

The DSCPD is subject to a range of important limitations and caveats. Some of these relate to well-known problems in using SAR information. Others relate to the specific assumptions and adjustments we make in using the SAR data. These limitations of the DSCPD are known and documented both in this report and more extensively in several reports preceding this one.[1]

The following are the main problems identified in using SARs to calculate cost growth: the failure of some programs to use a consistent baseline cost estimate, exclusion of some significant elements of cost, exclusion of certain classes of major programs (e.g., special access), and unknown and variable funding levels for program risk.

The specific or probable effect that each of these problems has on cost growth estimates varies across weapon systems. When estimating cost growth, the analyst can make adjustments and assumptions that reduce the potential for distortion but cannot entirely eliminate these problems since many of them defy measurement or an analytical solution.

Still, there are accepted analytical approaches for dealing with two types of changes that can have a tremendous and measurable impact on cost growth. These include a change in the economic forecast (inflation) and a change to the originally programmed quantity. Measuring cost growth in then-year dollars without regard to changes in the procurement quantity reflects the budgetary impact of all program changes regardless of what conditions are responsible for the change. However, for purposes of assessing policy initiatives and underlying trends, most analysts agree that the data should be adjusted for changes in inflation and changes to the original procurement quantity.[2] Since there are differing viewpoints regarding the nature of "real" cost growth, the DSCPD, as mentioned above, presents cost variables both with and without quantity adjustments.

Even though SAR data have a number of limitations when used for purposes of calculating cost growth, they nevertheless are suitable for identifying broad-based trends and temporal

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[1] Additional information, including analyses using the database, can be found in two companion reports: Paul G. Hough, *Pitfalls in Calculating Cost Growth from Selected Acquisition Reports*, Santa Monica, Calif.: RAND, N-3136-AF, 1992; Jeffrey A. Drezner et al., *An Analysis of Weapon System Cost Growth*, Santa Monica, Calif.: RAND, MR-291-AF, 1993.

[2] This is because most analysts feel that unanticipated inflation and quantity changes are largely beyond the control of the estimator and the program manager.

patterns across a range of programs. The key to their use is to understand their limitations. In this way, the analyst can make the best possible adjustments and the decisionmaker can better interpret the results.

ACKNOWLEDGMENTS

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Any remaining errors are the responsibility of the authors.

ACRONYMS

AMRAAM	Advanced Medium-Range Air-to-Air Missile
ATF	Advanced Tactical Fighter
CBO	Congressional Budget Office
CE	Current estimate
CGF	Cost growth factor
DE	Development estimate
DoD	Department of Defense
DSCPD	Defense Systems Cost Performance Database
EMD	Engineering and manufacturing development
FSD	Full-scale development
IOT&E	Initial operational test and evaluation
MDAPs	Major Defense Acquisition Programs
MICV	Mechanized Infantry Combat Fighting Vehicle
MILCON	Military construction
NDI	Nondevelopment item
OD (PA&E)	Office of the Director, Program Analysis and Evaluation
O&S	Operations and support
OSD	Office of the Secretary of Defense
PdE	Production estimate
PE	Planning estimate
PEA	Point Estimate Analysis
PLSS	Precision Location Strike System (Air Force)
R&D	Research and development
RDT&E	Research, development, testing, and evaluation
SAR	Selected Acquisition Report
SUBACS	Submarine Combat System (Navy)
TOA	Total Obligated Authority
TOW	Tube-launched, optically tracked, wire-guided

1. INTRODUCTION

BACKGROUND

Cost growth has a different meaning for varying objectives. It is often referred to as the difference between estimated and actual costs. We, however, define cost growth as the difference between the initial estimate of the total acquisition cost for a program and the most recent or final estimate, adjusted for inflation and quantity changes.[1] The direction of the deviation measured from the estimate baseline can be either to understate costs initially, in which case cost growth occurs, or to overstate costs, in which case cost reduction is realized. The effect on decisionmaking is the same, however; both overruns and underruns reduce the quality of resource allocation decisions. This report uses the term cost growth to include both cost increases and decreases from the estimate baseline.

Cost growth is important from a policy perspective because a systematic bias in cost estimates can distort resource allocation decisions, invalidating the rationale that led to those decisions. This is particularly important in an environment of scarce resources. To inform this continuing debate, RAND has developed an historical database of cost and cost growth information. The database and associated analysis provide policymakers with a better understanding of the history, factors, and issues in cost analysis of major weapons systems.

The Defense Systems Cost Performance Database (DSCPD) was developed at RAND over the past several years under both Air Force and Office of the Secretary of Defense (OSD) sponsorship.[2] The database uses information from the Selected Acquisition Reports (SARs) and was developed to support analyses of cost growth and related issues. It is an important resource in the continuing effort to improve weapon system acquisition.

PURPOSE OF THE REPORT

While the results of several analyses using DSCPD have been available in the past, the database itself has been available only to RAND and the Office of the Director, Program Analysis and Evaluation (OD(PA&E)). It has been the desire of both RAND and OD(PA&E) to distribute this resource more widely within the Department of Defense (DoD) cost-analysis community.

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[1] Cost data are presented in the database with and without quantity adjustments.

[2] Air Force funding in FY89 and FY90 supported initial development of the database and collection of historical information. Office of the Director, Program Analysis and Evaluation (OD(PA&E)) support in FY91-FY94 allowed updating and automation.

The intent is to improve the breadth, depth, and consistency of research on weapon-system cost-growth issues specifically and on defense program cost issues in general.

The purpose of this report is to describe the contents of the database in enough detail to facilitate its use by interested analysts. The report is intended to provide analysts with an understanding of the data sources, structure, and methodology used to develop the database. The report also provides database users with important assumptions, caveats, and limitations of the database.[3]

PURPOSE OF THE DATABASE

The database itself was designed to provide a basis for research attempting to explain the factors affecting cost growth. The database offers a small set of explanatory variables in the areas of cost, schedule, and categorical information. Cost growth may be calculated for categories such as service, weapon system type, and development strategy. The use of overall time trends in cost growth for research, development, testing, and evaluation (RDT&E) and procurement are facilitated. Additionally, the database supports the exploration of the relationship between cost and schedule.

ORGANIZATION OF THE REPORT

The remainder of the report is organized in the following way. Section 2 describes the data sources used in DSCPD. The description includes a discussion of assumptions, caveats, and limitations. Section 3 describes the database in some detail, including an overview of its architecture and the three types of data files. Because of general interest and the importance of quantity adjustments to some of the calculated cost growth outcome, Section 4 describes the quantity normalization approach. Appendix A lists and describes the variables included in the DSCPD, including both original and calculated data. Appendix B is a list of programs included in DSCPD as of the December 1994 SAR, along with the current reporting status of the program. Appendixes C through E provide the guidelines and rationale for several categorical variables: weapon type, prototyping, and modification classifications. Appendix F lists the data files included as part of this report.

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[3] Additional information, including analyses using the database, can be found in two companion reports: Paul G. Hough, *Pitfalls in Calculating Cost Growth from Selected Acquisition Reports*, Santa Monica, Calif.: RAND, N-3136-AF, 1992; and Jeffrey A. Drezner et al., *An Analysis of Weapon System Cost Growth*, Santa Monica, Calif.: RAND, MR-291-AF, 1993.

2. DATA SOURCES

Selected Acquisition Reports (SARs) are the primary means by which the Department of Defense reports the status of major acquisitions to Congress. SARs are publicly available (though generally classified) and provide reasonably consistent and relatively reliable data on the cost, schedule, and performance status of DoD acquisition programs at regular intervals. Consequently, SARs are the primary data source for the DSCPD. This section briefly describes the contents of SARs and provides some cautions concerning the use of SAR data in cost growth analysis.

SAR HISTORICAL BACKGROUND

SARs originated as internal DoD management documents. They have been informally submitted to Congress since 1969 but were not mandated until 1975. (PL 94-06, The FY76 Defense Appropriations Act). The current SAR regulation is published as Part 6.2.4 of DoD Regulation 5000.2-R (15 March 1996). Format, reporting thresholds, and specific information included have changed several times since SARs were established. The current reporting thresholds which apply to Major Defense Acquisition Programs (MDAPs) are $355 million for RDT&E and $2.135 billion for procurement (in base-year 1996 dollars).[4]

SARs are developed by weapon system program offices. They are part of the mandatory documentation and reporting requirements associated with MDAPs.

INFORMATION CONTAINED IN THE SAR

The SAR includes schedule, technical, and cost information summaries on major programs that meet reporting criteria. Data are reported in terms of baseline, approved program, and current estimates. Depending on the phase of the acquisition cycle, the baseline values are represented by the planning estimate (PE), the development estimate (DE), or the production estimate (PdE). The approved program includes schedule, technical, and cost information taken from the acquisition program baseline. The current estimate includes actual schedule, technical, and cost information for the most recent estimate of these available. The cost information sections include baseline and current estimates for all acquisition costs, including RDT&E, procurement, and military construction (MILCON). Procurement costs are sometimes provided

[4]Earlier additions of this regulation contained descriptions of format, reporting requirements, and calculations (see DoD 5000.2, Part 17, 23 February 1991). In 1991, reporting thresholds were $300 million for RDT&E and $1.8 billion for procurement. The reporting thresholds established in 1983 were $200 million for RDT&E and $1 billion for procurement (in base-year 1980 dollars). See Hough, 1992, for a detailed history.

at a more detailed level, but rarely by major component. A cost variance section identifies the change in program costs from the previc SAR, as well as cumulative changes to date from the baseline. Very brief descriptions of the reasons for these changes are also given, aggregated into seven categories that are oriented toward program effects: escalation, quantity, schedule, engineering, support, economic, and other. These costs are reported in both program base-year and then-year dollars.

Schedule information is reported in a similar fashion, with the estimate, approved plan estimate, and current estimate of various acquisition milestones given. For the most part, SARs provide only the most basic schedule milestones: formal acquisition decisions and major testing and production milestones. Narrative sections entitled Mission and Description, Program Highlights, and Decision Coordinating Paper Threshold Breaches provide other important program data. Similarly, performance (technical) information is provided in the SAR.[5] The DSCPD makes available selected information not related to cost as potential explanatory variables in various cost growth analyses (see Appendix A).

GENERAL LIMITATIONS

SAR data are useful in program cost research because of their scope, relative consistency, and their length of coverage. However, while directives governing SAR preparation are intended to be applied consistently across programs and between the services, differences do arise in practice. Such differences can result in distorted cost growth factors derived from SARs. This section discusses the adjustments made to maintain the relative consistency of the data.

Baseline Problems

There are three types of baseline estimates (planning, development, and production) that are measured and tracked, each roughly corresponding to a decision point in the acquisition process. As a general rule, once a baseline has been established, the first estimate presented as that baseline should be used in calculating cost growth. However, at times, SAR baselines can be unstable. For instance, occasionally a second, more accurate estimate is substituted for the original estimate, generally improving cost performance as measured from this new baseline. Alternatively, changes that reflect an entirely different work scope from the original baseline may falsely portray poor cost performance.

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[5]This information is generally classified and so is difficult to use in an unclassified environment. While earlier versions of DSCPD have made limited use of performance data, current versions have dropped this information because of data quality, measurement, and interpretation problems.

Programs may even be canceled, then brought back with updated baselines, resulting in an apparent improvement in cost estimating performance. An example of this is the Precision Location Strike System (PLSS, Air Force). This program was canceled in 1981, resurrected in 1983, and canceled again in 1986. The original DE for total system cost was $678.2 million (base-year 1977) for a quantity of three. The updated DE in the December 1983 SAR reported a total system cost of $635.5 million (base-year 1977) for a quantity of one. The new DE was significantly higher and would have resulted in a much lower cost growth factor had we used it as the baseline estimate.

In some cases, using a new baseline may be justified if the program has significantly changed in scope, or the new system is different from the system for which the original DE was made. An example of this is the Bradley Fighting Vehicle System (Army), whose original DE was based on a predecessor vehicle, the Mechanized Infantry Combat Fighting Vehicle (MICV). The Bradley included a 25-mm gun and the tube-launched optically tracked wire-guided (TOW) missile system (the TOW system is a separate SAR program), while the MICV had only a 20-mm gun. Clearly, the original DE, when compared with the cost estimates for the Bradley, its 25-mm gun, and ammunition, would result in excessive cost growth. In this case, the original DE was not a fair basis for measuring cost growth; the current DE (made after the cancellation of the MICV) was closer to a production baseline. We, therefore, added costs identified in the SAR as being associated with the new configuration to the PE and DE baselines to bring the estimates in line with the final design configuration of the vehicle.

Another baseline problem comes with combinations or separation of programs. Sometimes programs are reorganized and combined with other programs. Similarly, large programs consisting of several subsystems that were formerly contained in one program SAR are sometimes broken out into individual programs, each with its own SAR. These changes result in fairly severe distortions. Often, a large portion of the cost is lost or gained, while the baselines are unchanged, resulting in very large changes to the cost growth factors. The Submarine Combat System (SUBACS, Navy) is a good example of this. In December 1983, the SAR for SUBACS included a DE for two major subsystems, the AN-BSY 1 and the AN-BSY 2. Subsequently, AN-BSY 2 was removed from the SAR in December 1985, reestablished as a separate SAR program in December 1986, and was incorporated into the SSN-21 SAR in December 1990. While we would have liked to maintain consistency with the original DE and combine the two subsystems and treat them as one, the lack of detail reported for the AN-BSY 2 in the SSN-21 SAR made it impossible without making too many blind assumptions. In the end, the AN-BSY 2 costs were stripped from the SUBACS program and included in the SSN-21 program, thereby, changing both the AN-BSY 1 and SSN-21 baselines. If we had left the baselines as they were, we would have

seen understated cost growth in the SUBACS program and greatly overstated cost growth in the SSN-21 program.

Unfortunately, SARs do not provide enough information to separate models in a series. Thus, the costs of the F-15C/D or E versions cannot be separated from the original A/B version, even though the modifications were substantial. Thus, some observed development cost growth is due to development program costs for a major modification program added to the original development costs. Procurement costs may also increase because of the cost of performance enhancements not envisioned in the original SAR.

In summary, changes to baselines have to be carefully scrutinized to preserve consistency over time within a program. If a large portion of the program has been dropped (or added), adjustments must be made to the baseline estimates to ensure that they reflect these changes. Failure to do so would result in large, unwarranted changes in cost growth factors. Often the SARs provide the necessary adjustment factors, but not always.

Exclusion of Costs

Historical costs as reported in the SARs reflect appropriated amounts and are not necessarily the estimates prepared by cost estimators. In fact, the December SAR for a program must be consistent with the President's Budget submitted the following January and covering future fiscal years. The appropriated budget reflects the basic input of the cost estimator, subject to adjustments by program offices, changes by service and DoD comptroller organizations, and congressional revisions. Cost values in the SAR are the net result of these modifications.

A major cost element omitted from the total system cost estimate in the SAR data are the operations and support (O&S) costs. Prior to 1989, O&S costs were not reported in the SAR. It was DoD's contention that these estimates were too unreliable and as such, were justifiably excluded. If program deficiencies result in excessive O&S costs, real, but unreported, cost growth has occurred.

Technical deficiency (or performance variance) is a different form of cost growth. Failure to achieve technical specifications results in real cost growth, either in remedial actions or foregone capabilities. Unfortunately, it is impossible to systematically adjust costs for such performance shortfalls to reflect the cost of fixing these shortcomings. Cost growth will be understated to the extent that such shortfalls occur. For example, using SAR information, the B-1B essentially met its cost goal. However, substantial costs to fix technical performance shortfalls are not included in the SAR (e.g., defensive avionics improvements).

SARs report only costs to the government, rather than total investment costs, and thus do not include contractor investment in the programs, nor do they include overruns that the

contractor covers. This is particularly true in fixed price contracts, where contractors are forced to pay for program overruns. Cost growth will be understated to the extent that reported costs do not include contractor investment. The Advanced Medium-Range Air-to-Air Missile (AMRAAM) is a good example of this: Hughes incurred several $100 million in expenses not covered by the fixed price contract and so not reported in the SAR. During the Advanced Tactical Fighter (ATF) competition, the contractors were estimated to have invested in excess of $1 billion in fabricating the prototypes. Thus, the ATF/F-22 SAR severely understated the program costs.

The SARs do not represent all system costs. The components included in different programs vary considerably, often at the discretion of the program office. To the extent that a program manager is able to limit the number of high-risk (and subsequently high cost growth) components included in the program, cost growth may be underrepresented. This factor complicates comparisons between programs.

Risk is inherent in weapon system development, and funds are sometimes allocated to cover potential costs associated with identified program risks. Unfortunately, SARs do not reveal the amount allocated as a management reserve. Since the amount of contingency funds cannot be separated from the total funding for each program, the impact of these funds cannot be estimated.

The inflation factors used in the SAR are provided by OSD. These are projected out many years into the future, and permission to adjust them is rarely given. To the extent that OSD inflation estimates are lower than actual inflation, the baseline estimate will be lower, resulting in higher cost growth for a given spending level.

Exclusion of Certain Classes of Major Programs

The number of programs reporting in each year will vary as a function of the number of carryovers from the previous year, the number of new programs, and the number of terminations (cancellations or completion). On average, SAR reporting programs represent 45 to 55 percent of total DoD procurement.

As noted earlier, SARs are created only for major systems that are budgeted at over $355 million in R&D and $2.135 billion in procurement in FY96 dollars. If minor programs have considerably different cost growth patterns and these programs constitute a significant portion of DoD spending, aggregate cost growth measures based on SAR programs may be misleading.

Similarly, the number of programs covered by SARs is limited to non-compartmentalized programs. Special access program SARs (e.g., B-2 and A-12) are not publicly available and may not exist in some cases. If we assume that special access programs are more technologically advanced and thus represent greater risk, (and subsequently endure higher cost growth), aggregate

cost growth measures based on SAR programs may underestimate cost growth for defense spending as a whole.

The limitations discussed in this section do not render the DSCPD invalid; however, they do imply the need for caution when using the DSCPD. While the problems themselves lack an analytic solution, they can be addressed by carefully and consistently applying a set of reasonable rules and assumptions. The key is to understand the potential effects of these problems and interpret the results of analysis accordingly. Cost growth analyses that rely on SAR data are useful for capturing broad-based trends and temporal patterns.

3. DATABASE STRUCTURE AND CONTENTS

To enable proper use of the DSCPD, an analyst needs a detailed description of the structure of the database, the specific variables included, and important calculations and assumptions. This section addresses these topics and is organized around the structure of the DSCPD. After a brief overview of database architecture, each of the three different types of files included in the database is discussed.

OVERVIEW OF THE DATABASE

Contents

The database currently includes information on 244 weapon system programs, the earliest development program starting in 1960 and is current through the December 1994 SAR. Table 3.1 provides a cross-tabulation of weapon system type and agency responsible for program management. Of the 244 programs in the DSCPD, 112 are currently reporting programs as of the December 1994 SAR. The remainder are inactive for a variety of reasons (see Appendix B). Navy systems are the most heavily represented (41 percent of the total), followed by Air Force systems (30 percent), and then Army systems (27 percent). Four weapon system categories dominate—electronics and missiles each account for about 26 percent of the total, while ships and aircraft combined account for another 25 percent.

Table 3.1

System Type by Management Agency

Weapon Type	Air Force	Army	Navy	OSD	Total
Aircraft	16	0	16	0	32
Helicopter	1	7	2	0	10
Missile	20	21	20	1	62
Electronic	22	19	23	1	65
Munitions	2	9	4	0	15
Vehicle	0	9	2	0	11
Ship	0	0	29	0	29
Space	9	1	1	0	11
Other	2	1	3	3	9
Total	72	67	100	5	244

This distribution includes all major systems reporting through the SAR since it was established in the late 1960s, except for 16 very early programs (see Appendix B), which never reported costs in base-year dollars.[6]

Structure

The DSCPD consists of several spreadsheet-based data sets containing categorical, schedule, cost, and quantity information on major weapon system acquisition programs. Categorical data include information on the lead service, contractor, system type, and aspects of the development strategy. Schedule information includes formal acquisition decision milestones, testing, and delivery dates. Cost information includes development, procurement, and military construction baseline estimates and estimate histories. Quantity information includes information on baseline and current R&D and procurement quantities. As described in more detail below, such information is used either directly to calculate cost growth factors or as potential explanatory variables (with cost growth as the dependent variable), or indirectly to calculate relevant variables or sort the database.

The DSCPD is composed of three types of files: program files, a Point Estimate Analysis (PEA) file, and time trend files. Program files are the basic information source and are specific to each program. Each program file contains a table and records the cost and quantity information and normalization models used to calculate the total program cost growth for each program year. These are the data source files, and they provide information used by the two types of analysis files--PEA and time trend.

The PEA file is a matrix that provides categorical, schedule, and cost information for each program. The information in this file is used to calculate descriptive statistics of the most current cost growth data and to perform analyses of potential factors affecting that cost growth.

The time trend files contain tables of cost growth factors (CGFs) as a function of time for every program. These files draw information from the program files for each baseline available. The relationship between the files is illustrated in Figure 3.1. The program files feed information to the PEA and to the time trend files for analysis.

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[6] Without an annual expenditure profile, it is not possible to adjust the data in these early programs from then-year to constant dollars. Such profiles were not available; therefore, we did not include these programs in the database.

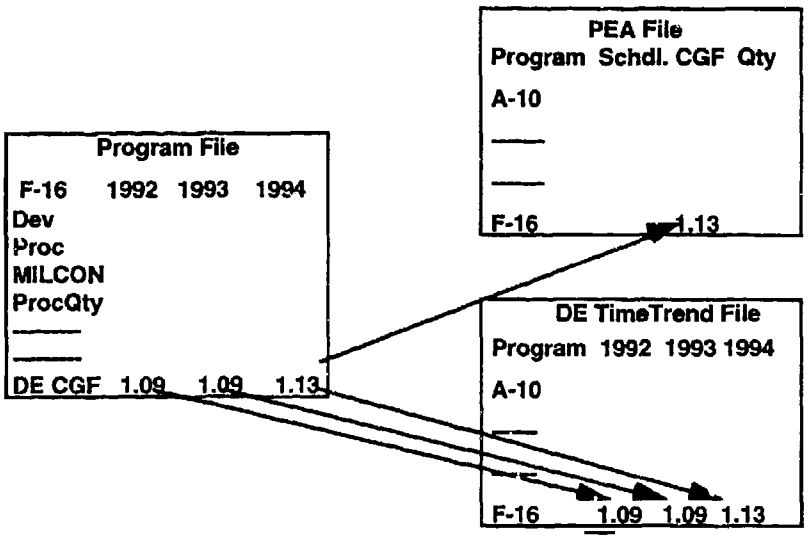

Figure 3.1—Basic Structure of SAR Cost Growth Database

Baseline Estimates

There are three types of baseline estimates that are measured and tracked, each roughly corresponding to a decision point in the acquisition process. In performing cost growth analyses, it is important to distinguish among the different baseline estimates since cost growth is measured with respect to a specific baseline. Each baseline is roughly associated with a specific decision point in the weapon system acquisition cycle. The PE is associated with Milestone 1 in the acquisition process, the DE with Milestone 2, and the PdE with Milestone 3a.[7] Most programs do not have all three cost baselines. In some cases, we estimated a PdE baseline using the current estimate costs reported in the SAR corresponding to the Milestone 3a decision point.

Since a program may have more than one baseline from which cost growth is measured (see Table 3.2), there are 335 total data points. Of the 244 programs currently in DSCPD, there are only six systems that have all three baseline estimates, and the PdE was estimated for two of them.[8]

[7]Refer to Appendix A for a brief definition of the acquisition milestones. These are derived from DoD Directive 5000.2, *Acquisition System Management*.

[8]The six systems are DDG-51, C/MH-53, M-1, Bradley FVS, C-17, and AH-64.

Table 3.2

Number of Programs by Baseline Estimate

Type of Estimate	Number of Programs
Planning	57
Development	174
Production	104
Planning & development	27
Development & production	61
Planning and production	10
Planning & development & production	6
Planning or development or production	335

For many types of descriptive and statistical analyses, cost growth is referenced to the DE baseline since prior to Milestone 2, capability and configuration trade-offs are often still in the process of being resolved. Using this baseline also establishes a weapon system of reasonably constant scope in cost growth analyses.

PROGRAM FILE ORGANIZATION

The program files contain the basic cost and quantity information drawn from the SAR, as well as the calculations and models used in the data adjustment and normalization procedure. Thus, the transition from basic cost data to a normalized cost growth factor is transparent. The program files contain adjusted and unadjusted data that feed into the other two types of files.

The program files are organized in a matrix, as shown in Table 3.3. Specific program information, listed in rows, is labeled in the first column, with subsequent columns containing values for each variable. The data are organized by the SAR publication date. The program file is divided into several sections containing data and calculations of different types.

Variables and Structure

The development, procurement, military construction, and quantity entries are taken directly from Section 11 of the SAR. Costs are always taken in base-year dollars, and the base year is listed in the program file. All SARs in a program are examined, but only the December SAR data for each year are recorded in the program file, unless there was a change in the planned procurement quantity during that year. In that case, the SAR that documents the quantity change and the SAR immediately prior to it are included as well.

The difference from one SAR to the next is calculated for each of these cost data types. The current estimate procurement variance (CE Proc Var in Table 3.3) is created by subtracting the previous SAR's procurement cost from the current procurement cost. The quantity variance (Qty Var) reported (in dollars) is taken from the current changes part of Section 11 of the SAR under the quantity variance category. Since we know that other cost impacts of quantity changes are reported under other variance categories, we calculate a quantity variance adjustment by adding all of the quantity related changes (in base-year dollars) identified in SAR variance categories other than quantity and, therefore, not accounted for in the quantity category.[9] The net current estimate variance is created by subtracting the quantity variance reported and quantity variance adjustment from the current estimate procurement variance. The result is a net procurement variance that has been adjusted for most of the quantity change effects.

The cost-quantity curve (Cost/Qty Curve) is used in the cost growth normalization calculation described in Section 4 of this report. The cost-quantity, or learning, curve predicts changes in cost as the number of items produced changes. Data to generate the cost-quantity curve come from Section 16 of the SAR, which gives annual appropriations and quantities for all procurement programs beginning in 1986. If a learning curve cannot be generated for a particular program, the average value for similar systems is used. The normalized net current estimate variance (Norm Net CE Var $) is calculated by removing the observable effects of quantity changes as described in Section 4 of this report.[10]

The development variance (Develop Var $) is created by subtracting the current development cost estimate from the value of the previous year. Variance in military construction costs (MILCON Var $) is created by subtracting the current military construction cost estimate from the value of the previous year. Neither of these are adjusted for changes in quantity.

The cumulative variances in procurement, development, and military construction are used to calculate cost growth. The cumulative normalized net current estimate variance (Cum Norm CE Var $) is calculated by adding the normalized net current estimate variance values from the beginning of a baseline to the most current estimate. Similarly, the cumulative procurement current estimate (Cum CE Proc Var $) is the total amount of change in the current estimate of the procurement cost to date from the same baseline. The cumulative development current estimate (Cum Develop Var $) is the total amount of change in the estimate of the development cost to date from the same baseline. The cumulative military construction current estimate (Cum

[9]The quantity normalization procedure, including identification of quantity variance in the SAR, is explained in more detail in Section 4 of this report.

[10]The more general terms "cost variance" and "cost change" are sometimes used in place of "cost growth" because they are consistent with both increasing and decreasing costs. Here, we understand cost growth to include both negative and positive changes. Still, "cost variance" is the term usually employed in the SARs.

Table 3.3

Example Program File

PROGRAM: F-XXX	DE	Dec 92	Dec 93	Dec 94
Base year: FY90				
Development $	1549.2	1549.2	1496.8	1692.0
Procurement $	12849.6	12849.6	12966.1	13147.6
MILCON $	0.0	0.0	0.0	0.0
Total $	13398.8	13398.8	13462.9	13839.6
R&D Qty	4	4	4	4
Procurement Qty	350	350	300	200
Delta Proc Qty		0	-50	-100
CE Proc Var $		0.0	116.5	181.5
Qty Var Reported $		0.0	-50.0	-130.0
Qty Var Adjustments $		0.0	0.0	0.0
Net CE Var $		0.0	166.5	311.5
Cost/Qty Curve		n/a	85%	85%
Develop Var $		0.0	-52.4	195.2
MILCON Var $		0.0	0.0	0.0
Norm Net CE Var $		0.0	187.9	483.5
Cum Develop Var $			-52.4	142.8
Cum MILCON Var $			0.0	0.0
Cum CE Proc Var $			116.5	298.0
Cum Norm Net CE Var $			187.9	671.4
Total Cum Var $			135.5	814.2
DE CGF		1.00	1.01	1.06

NOTE: Development $, Procurement $, MILCON $, R&D Qty, and Procurement Qty are taken directly from the SARs. The normalization procedure used to derive the Norm Net CE Var $ is explained in Section 4 of this report. The remaining equations for cost variances and cost growth factors for years 1 through i are as follows:

Develop Var $ (i)	Development cost estimate (i) - Development cost estimate (i-1)
MILCON Var $ (i)	MILCON cost estimate (i) - MILCON cost estimate (i-1)
CE Proc Var $	Procurement cost estimate (i) - Procurement cost estimate (i-1)
Net CE Proc Var $	CE Proc Var $ - Qty Var Reported $ - Qty Var Adjustments $
Cum Norm CE Var $ (i)	Norm Net CE Var $ (1) + Norm Net CE Var $ (2) +... + Norm Net CE Var $ (i)
Cum CE Proc Var $ (i)	CE Proc Var $ (1) + CE Proc Var $ (2) + ... + CE Proc Var $ (i)
Cum Develop Var $ (i)	Develop Var $ (1) + Develop Var $ (2) + ... + Develop Var $ (i)
Cum MILCON Var $ (i)	MILCON Var $ (1) + MILCON Var $ (2) + ... + MILCON Var $ (i)
Total Cum Var $ (i)	Cum Norm Net CE Var $ (i) + Cum Develop Var $ (i) + Cum MILCON Var $ (i)
Total Program CGF (i)	Total Cum Var $ (i) / Total baseline estimate + 1.

MILCON Var $) is the total amount of change in the estimate of the military construction cost to date also from that baseline. All are calculated by adding the previous year's calculation to the current change in the estimate.

The total cumulative variance (Total Cum Var $) is the sum of the cumulative norm net current estimates, development, and military construction variances. The total program CGF is calculated by dividing the total cumulative variance in each column by the total baseline value and then adding one. The result is a factor in which cost increases are indicated by ratios greater than 1.0 and cost decreases are indicated by ratios less than 1.0. Cost growth can also be calculated independently for R&D, unadjusted procurement, and adjusted procurement. These values are calculated in the PEA file for the most current estimate.

For programs with more than one baseline, identical sets of calculations are made in separate sections. The formulas and calculations for each one are identical. Only the cost and quantity baselines from which cost growth is calculated are different.

The last section of the program files is reserved for notes. The notes include information on program name, what the procurement quantity measures (units), and the source of different baselines. They also include information on the learning curve, the source of the current estimate, and special information on the program, such as the involvement of other services. Any adjustments to the program costs shown in the SAR are also noted here. An example of this is the Bradley Fighting Vehicle System for which we adjusted the PE and DE baselines to bring the estimates in line with the final design configuration of the vehicle. Later Bradley SARs include the costs of the gun and 25-mm ammunition, while the original design (the MICV program) did not include these capabilities.

Assumptions and Caveats

In general, we have attempted to make adjustments to the data in the SAR to retain consistency with the program's original baseline as illustrated in Section 2. For the vast majority of programs in the database, no adjustment is necessary. For some, as mentioned earlier, costs may need to be added to or subtracted from either the baseline or the current estimate to ensure that the costs refer to the same basic system configuration.

There are other problems with the information in SARs that must be accounted for in the program files. The first is a change in base-year dollars. While the great majority of programs stay in the same base-year dollars, several programs have changed either baselines or the base year (some more than once) and thus have to be adjusted to a single base-year standard. The conversion factors used in the DSCPD are usually drawn from the SARs themselves. When these are not available, the factors are drawn from the Department of Defense Deflators Total Obligated

Authority (TOA) table found in the *National Defense Budget Estimates*, published annually by the DoD Comptroller. Usually, the later year costs are deflated to the original base-year dollars.

POINT ESTIMATE ANALYSIS FILE ORGANIZATION

The PEA file contains the widest range of data types: categorical, cost, and schedule. It is used for descriptive statistics and analysis when final cost growth (or most current estimate) is of interest. It is organized in a matrix format, with programs listed in rows and variables listed in columns. Programs are listed first by service and then alphabetically within each service. The database (as of December 1994) is made up of 244 programs and 84 variables. A table of deflators necessary to transform the different base-year dollar estimates from individual programs to the base year of the database (FY96 in the December 1994 version) is to the right of the main body of the database.

Variables and Structure

Database variables are categorical, schedule, cost, and quantity information and are grouped accordingly. Categorical variables are descriptive, classifying each program into one of several categories. Service and weapon system type are included, as are several designations relating to prototyping strategy and whether the program is a modification of an existing system. The prime contractor is also identified. Schedule variables include both specific event dates (milestones) and quantitative measures derived from those dates (schedule intervals and slip). Cost variables include baseline and current cost information and quantitative measures based on that information. Cost information is drawn directly from the program files described earlier. When available, planned and actual schedule milestones and intervals are determined. The basic set of variables contained in the database are listed in Table 3.4. These variables are not inclusive of all variables that might be interesting, but rather provide a starting point for analyses of factors affecting cost growth. A description of each variable, relevant calculations, and the section of the SAR in which the variable is found, or from which it is derived, appear in Appendix A.

Assumptions and Caveats

The cost and cost growth information is drawn directly from the program files and is subject to those caveats discussed earlier. The categorical variables are determined using information available in the SAR, sometimes supplemented with other sources. Determining the lead service is fairly straightforward, but judgment is required in determining weapon system, prototyping, and modification classifications. The guidelines used to make these categorizations, and the rationale for each program, are provided in Appendixes C through E.

Table 3.4

Variables in Database

Categorical	Schedule	Cost and Quantity
Program	Year of program initiation	Current development costs
Service	Year of development start	Current unadjusted procurement costs
Weapon Type	Year of production start	Current adjusted procurement costs
Contractor	Years past program initiation	Current military construction costs
Prototype	Years past development start	Baseline development costs
Confidence	Years past production start	Baseline procurement costs
Prototyping phase	Milestone 1	Baseline total program costs
Precedent	Milestone 2	Development cost growth factor
Modification	Milestone 3a	Unadjusted procurement cost growth factor
	Initial operational delivery	Adjusted procurement cost growth factor
	IOT&E start and complete	Total program cost growth factor
	Phase 1 length	Ratio R&D$/Proc$ (baseline)
	Phase 2 length	Ratio R&D$/Proc$ (current estimate)
	Total program length	Baseline quantity
	Phase 1 slip	Current quantity
	Phase 2 slip	Quantity change from baseline
	Total program slip	
	Percentage slips	
	Ratio Phase 1 to Phase 2	
	Slip in IOT&E	
	Concurrency measure (percent)	
	Concurrency measure(months)	

NOTE: IOT&E = Initial operational test and evaluation.

NOTE: Development costs and military construction costs are not adjusted for quantity.

The schedule information used in the point estimate file is drawn from Section 9 of the SAR. Schedule information is updated each year as new SARs become available. The information is usually clear, and the dates used for the variables can be readily identified. On occasion, the information does not correspond exactly with the variables, and thus adjustments have to be made.

Several decision rules have been created to ensure consistency in making these adjustments. In general, milestone dates are used when they are available, and contract award dates are used as proxy indicators for milestone dates when necessary. In the absence of information about a given baseline, approved program data can be used, but this is extremely rare. Baseline schedule information is not changed even if new information becomes available. In other words, variables containing planned dates do not change if a new SAR offers a new date for

a planned milestone in place of one from a previous SAR for that same milestone. Only in cases where an actual date is available where none had been before is new information recorded. This rule ensures that the integrity of the original program baseline is maintained.

If Milestone 3a is preceded by a production contract award, that date is substituted for the actual Milestone 3a decision. This is done to approximate the initial production decision.

Ships typically have different schedule milestones than other program types. To ensure consistency, the lead ship production contract is used as a proxy for Milestone 2 for ships that do not have a true development contract. The award of a follow-on production contract then becomes the proxy for Milestone 3a.

TIME TREND FILES

In addition to the program files and the PEA file, there are two additional types of files that are used to track the cost performance of systems over time. These files are linked to the program files in the same manner as the PEA file. They can also be linked with the PEA file to make use of additional categorical or schedule information.

Structure

The structural relationship between each of the time trend files and the program files is very simple. Each time trend file is linked to the program files with reference to the appropriate baseline. Each row in the time trend file represents a specific program. The columns represent specific dates. Thus, every cell in a given column will refer to the cost growth factor for a given SAR date for each of the programs in that file.

The two time trend file types are identical in structure but represent different types of cost growth trends. The basic time trend file tracks cost growth in terms of calendar years (1974, 1975, etc.) and are limited to programs with common baseline types (e.g., PE, DE, or PdE). Thus, separate files are created for each of the three baseline types. The second type of time trend file tracks cost growth as a function of years past engineering and manufacturing development (EMD) start. This file is critical to time-based analysis since it allows the effect of program maturity (age) to be incorporated into the analysis. Again, separate files are created for each of the three baseline types.

Only results from the December SARs are reported in the time trend files. When a December SAR is unavailable in a given year, the SAR released closest to that date is used.

Assumptions and Caveats

The time trend files are well suited for use as the basis for analytic experiments measuring cost growth over time. Comparisons of cost growth over both chronological years (e.g., 1975 vs. 1985) and maturity (the 5th and 10th years past EMD start) can be performed. Experiments using subsets of the database, such as all programs that are at least *n* years past development start, or that include at least *z* data points are possible. If one suspects that cost growth is a function of era and maturity, the time trend files provide an excellent base for research. Additional categorical variables from the PEA file can be incorporated as desired.

As is the case with all databases, one must be cautious in using the time trend files. For instance, the calendar year time trends do not account for maturity, and the years past development start do not account for era (a proxy for acquisition environment). Similarly, the point at which each program first submitted a SAR and thus enters the database is not necessarily the same across programs. Many programs report an initial SAR well into development, and thus the first cost growth factor does not necessarily correspond to when the program began. If desired, the time trend files can be sorted to control for these problems.

4. BASIC METHODOLOGY

OVERVIEW

In general, cost growth is measured as the difference between the initial or baseline estimate and the final or most recent estimate. While the definition of cost growth may seem fairly straightforward, varying opinions exist as to what should be counted and when the counting should start. This section provides an overview of the adjustments made to the data in calculating cost growth factors.

There are two common views as to what to count when calculating cost growth: unadjusted costs and adjusted costs. Unadjusted costs are measured in then-year dollars with no regard to changes in procurement quantity. This approach is favored by those who wish to measure the impact of cost growth on the federal budget. Adjusted costs are calculated in constant-year dollars and account for all changes in procurement quantities. For purposes of measuring the performance of program management in estimating and controlling costs, this is a more relevant measure. For instance, if a program procures half of the originally estimated quantity but still reaches maturity within the original budget, that program would show no cost growth using an unadjusted approach. If, however, in that same program, costs were adjusted for the reduction in quantity, one would see a sharp increase in cost growth. In such a case, cost performance is totally masked. Similarly, an older program that has more inflationary experience would have consistently higher cost growth than a more recent program. For these reasons, we choose to calculate cost growth with adjusted costs.

NORMALIZATION PROCEDURE

The first step in adjusting costs for any given program is to remove the effects of inflation. Since SARs provide costs in both base-year and then-year dollars, this step requires little effort. Adjusting for inflation in this case is reduced to extracting cost data and calculating cost growth factors in base-year dollars.

The second step, removing the effects of quantity changes, is a much more difficult task. All cost changes resulting from a change to the originally estimated quantity must be identified and removed. The information available in the SAR dictates to some extent how this amount is determined as seen below. To the extent that it can be determined, this information is used to adjust the current estimate to the same quantity level as the baseline estimate. It is possible to adjust the baseline estimate to the current estimate, but this produces a "floating baseline" and may lead to inconsistencies. It is an established RAND practice to retain the integrity of the

baseline by always adjusting the current cost estimate to what it would be if the program were still procuring the baseline quantity. This adjusting method is applied to each SAR submission for each program. The following is a detailed account of what is entailed in this process:

1. Calculate the current procurement variance by subtracting the previous procurement estimate from the current procurement estimate.
2. Determine the total quantity variance. This equals the sum of the cost variances reported in the quantity cost variance section and those in the narrative section that are clearly related to quantity but are reported in other variance categories such as schedule, support, engineering, or estimating. [11]
3. Derive the current net procurement variance equal to the current procurement variance (1) minus the total quantity variance (reported plus narrative) (2). This number represents any cost changes not due to quantity changes as reported in the SAR.
4. The current net procurement variance (3) is then run up or down the total program cost-quantity curve, depending on the direction of the quantity change. In this step we assume that all costs, direct and indirect, are driven by quantity.[12] Consequently, this "normalized" net procurement variance is stripped of all quantity induced effects, including changes in direct quantity, recurring cost per unit, cost-quantity curve slopes, and nonrecurring costs. The effect of the normalization procedure is usually minimal but can be high when both the net procurement variance and the quantity change are large.

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[11] For example, a large quantity increase for an aircraft procurement program will undoubtedly increase the requirement for initial spares. However, SAR guidelines require the cost variance for spares to be reported under the support category even though it is a direct result of the quantity change.

[12] The relationship between cost (c) and quantity may be represented by the log-linear equation

$$c = U * Q^{(S)}$$

where U = First unit cost
Q = Quantity
S = Cost-quantity curve slope expression: log slope/log 2.

The equation for deriving total cost (C) is

$$C = U * Q^{(S+1)}$$

The total program cost-quantity curve was derived from the annual funding summary in the December 1994 (or final) SAR provided that the regression yielded a measure of fit of at least $R2 > 0.70$. Of the 112 programs reporting costs in December 1994, 55 programs had $R2 > 0.7$, and 12 programs had $R2 < 0.7$. The range of observations for annual procurement buys was 5 through 34. When the least-squares line fit the data poorly, we used the average of "good" curves from the same class of weapon systems. The theory behind the normalization is explained in detail in E. Dews et al., Appendix A, 1979. Hough, 1992, also contains a good summary of the rationale underlying the normalization methodology.

5. The normalized net procurement variance (4) is added to the RDT&E and MILCON variances (not adjusted for quantity) to determine the total program cost variance (either positive or negative) between the previous estimate and the current estimate.

Finally, the total program cost variance (5) is added to the cumulative total cost variance to date and divided by the total program baseline cost. The adjusted cost growth factor is equal to this product plus one. A CGF over 1.0 indicates cost growth while a CGF less than 1.0 indicates cost reduction. We also calculated CGFs for RDT&E, adjusted procurement, and unadjusted procurement costs separately. The adjusted procurement cost growth uses the procedure described above but without adding development and MILCON variance; while the unadjusted procurement cost growth is simply the current estimate of procurement costs divided by the procurement cost baseline. Similarly, the RDT&E cost growth is the current estimate of development costs divided by the development cost baseline.

Appendix A
DESCRIPTION OF VARIABLES IN RAND'S DSCPD

This appendix lists and describes the variables that are included in either the point estimate or time trend files of the DSCPD. In some cases, the variable corresponds directly with the data as presented in the SAR; in other cases, raw data are used to derive a variable. The variables included in the database are not meant to be inclusive. Rather, they are meant to provide a starting point for further analysis. Other interesting potential explanatory variables can be identified that we have not explicitly included here.

The ordering in the list below corresponds roughly with the column headings in the PEA file. Some cost and schedule variables have both planned and actual (most current estimate) values; these are indicated in the variable description.

CATEGORICAL VARIABLES

Categorical variables are used to sort the database into subsets for further analysis or, when appropriately coded, as potential explanatory variables. Classifications other than program name and service are made by RAND based on information in the SARs or other sources.

Program—Refers to the program designation (e.g., F-15) and sometimes includes the program common name (e.g., Eagle).

Service—Refers to the military service with management responsibility for the program: Air Force, Army, Navy (includes Marine Corps), or OSD. For joint programs, the lead service is identified.

Weapon Type—Refers to the program's system type classification: aircraft, missile, helicopter, electronic, ship, space, munitions, vehicle, and other. In cases for which one system component is the primary cost element, that component is listed (e.g., AWACS is classified as an electronics system rather than as an aircraft). See Appendix C for details.

Contractor—Refers to the prime contractor on the program. Joint ventures are also noted.

Prototype —Refers to whether or not the program contained a prototype phase. Based on RAND definition of a prototype (see Drezner, 1992). See Appendix D for details.

Confidence —Refers to the degree of confidence RAND had in making the prototyping determination: high, medium, and low. Based on the quality and relevance of information available.

Prototyping Phase - Refers to the phase of development in which the prototype was built, either demonstration/validation (pre–Milestone 2) or during EMD (post–Milestone 2).

Precedent—Refers to whether or not there was a precedent to the program. Categories include direct prototype, indirect prototype, previous model, or none. Information is similar to that used to make prototyping determination and is meant to capture similar effect.

Modification—Refers to whether or not the program is a modification to an existing system. (See Appendix E for details.)

SCHEDULE VARIABLES

Schedule variables are potential explanatory variables with respect to cost growth. Basic information is collected on assorted Milestones, and interval information is calculated. Ratio variables (e.g., percentage slip) can be calculated from the interval variables. Schedule information is found in Section 9 of the SAR. An attempt is made to ensure that dates provided under particular systems are functionally equivalent, even if they are labeled differently.

Year of Program Initiation—The year associated with the Milestone 1 date.

Year of Development Start—The year associated with Milestone 2 or the date on which full-scale development (FSD)/EMD began.

Year of Production Start—The year associated with Milestone 3a or the date on which low-rate production began.

Years Past Program Initiation—The amount of time (in years) that has passed between Milestone 1 or the award of the original contract and the last or most current SAR. Calculated by subtracting the program initiation date from the latest SAR date.

Years Past Development Start—The amount of time (in years) that has passed between EMD start (Milestone 2) and the last or most current SAR. Calculated by subtracting the development start date from the latest SAR date.

Years Past Production Start—The amount of time (in years) that has passed between low-rate production start (defined as Milestone 3a) and the latest program SAR. Calculated by subtracting the production start date from the latest SAR date.

Milestone 1—The actual date on which entry into a demonstration/validation phase was approved.

Milestone 2—The date on which entry into full scale/engineering and manufacturing development is approved. Both *planned* and *actual* dates are identified if available.

Milestone 3a—The actual date on which production was approved. The chosen metric refers to the start of low-rate production. Older programs may have only a Milestone 3 date. A proxy for this milestone is award of first production contract.

Initial Operational Delivery—The date on which the initial production article is delivered to an operational unit. If available, both *planned* and *actual* dates are identified.

IOT&E Start—The date on which initial operational test and evaluation[13] (IOT&E) starts. If available, both *planned* and *actual* dates are identified.

IOT&E Complete—The date on which initial operational test and evaluation is completed. If available, both *planned* and *actual* dates are identified.

Phase 1 Length—The amount of time in months between Milestones 1 and 2. This information is found by subtracting the Milestone 1 date from the Milestone 2 date. If available, both *planned* and *actual* intervals are calculated.

Phase 2 Length—The amount of time in months between development start and completion. This information is found by subtracting the Milestone 2 date from the initial operational delivery date. If available, both *planned* and *actual* intervals are calculated.

Total Program Length—The amount of time in months between program initiation and first operational delivery. This information can be calculated either by determining the time interval between Milestone 1 and first delivery, or adding the Phase 1 and Phase 2 lengths. If available, both *planned* and *actual* intervals are calculated.

Phase 1 Slip—The difference in months between the planned and actual Phase 1 interval.

Phase 2 Slip—The difference in months between the planned and actual Phase 2 intervals.

Total Program Slip—Refers to total program slip, measured by the difference (in months) between planned and actual first operational delivery dates. Can also be calculated by adding Phase 1 and Phase 2 slips.

Percentage Slip in Phase 1—The slip between program initiation and Milestone 2 development start as a percentage of the total planned program length.

Percentage Slip in Phase 2—The slip between Milestone 2 and first operational delivery as a percentage of total planned program length.

Percentage Total Program Slip—The schedule slip associated with first operational delivery as a percentage of the original planned total program length.

Ratio of Phase 1/Phase 2 Length—The ratio between the length of Phase 1 to the length of Phase 2. This is found by dividing the Phase 1 interval by the Phase 2 interval. If available, both *planned* and *actual* interval ratios are calculated. The ratio is intended as a measure of relative level of effort expended early in the program.

Slip in IOT&E—The difference in months between planned and actual IOT&E completion. This is found by subtracting the planned IOT&E completion date from the actual IOT&E completion date.

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[13]If there is no IOT&E given in the SAR, then dates for operational testing may be used as proxies. However, only "operational test 2" can be used in this manner.

Concurrency Measure (percentage)—The concurrency measure (percentage) refers to an overlap in time and effort between the development and production phases of a program. Since operational testing is supposed to precede production approval, the amount of operational testing that occurs after production begins is a reasonable measure of this overlap. The percentage is calculated by subtracting the actual IOT&E date from the Milestone 3a date and dividing the result by the difference between the planned and actual IOT&E dates. The result is then multiplied by 100. This measure was originally developed by the CBO.[14]

Concurrency Measure (interval)—The concurrency measure (interval) refer to an overlap in time and effort between the development and production phases of a program. Since operational testing is supposed to precede production approval, the amount of operational testing that occurs after production begins is a reasonable measure of this overlap. The interval is calculated by subtracting the Milestone 3a date from the actual IOT&E completion date. It is intended as a simpler measure of overlap between development and production.

COST AND QUANTITY VARIABLES

Cost and quantity information is found in Section 11 of the SAR. Some of the basic cost and quantity information collected is used to calculate cost growth factors. Other information is used as potential explanatory variables. Cost and cost growth information is provided for all three baseline types (planning, development, and production) when available.

Development costs—Refers to the development cost estimate (FY96 dollars) at the latest SAR available.

Unadjusted Procurements costs—Refers to the procurement cost estimate (FY96 dollars), unadjusted for quantity changes, at the latest SAR available.

Adjusted Procurements costs—Refers to the procurement cost estimate (FY96 dollars), adjusted for quantity changes, at the latest SAR available.

MILCON costs—Refers to the MILCON cost estimate (FY96 dollars) at the latest SAR available.

Baseline development costs—Refers to the development cost estimate (FY96 dollars) made at a given baseline.

Baseline procurement costs—Refers to the procurement cost estimate (FY96 dollars) made at a given baseline.

Baseline Military Construction costs—Refers to the military construction cost estimate (FY96 dollars) made at a given baseline.

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[14]See Congressional Budget Office, 1988.

Baseline Total Program costs—Refers to the total program cost estimate (FY96 dollars) made at a given baseline. This includes RDT&E, procurement, and military construction. There is one value for each baseline in a program. This is the variable used as weights in calculating weighted average cost growth. Using the estimated ratios of development to procurement costs (see above), this value can be broken down into estimated baseline development and procurement costs for use in weighting development and procurement CGFs.

Development Cost Growth Factor—Refers to the ratio of actual, or most current, development costs to the development cost estimated at a baseline, calculated in program base-year dollars. There is one R&D CGF for each baseline in a program.

Unadjusted Procurement Cost Growth Factor—Refers to the ratio of actual or most current unadjusted procurement costs to procurement costs estimated at a given baseline, calculated in program base-year dollars. There is one value for each baseline in a program.

Adjusted Procurement Cost Growth Factor— Refers to the ratio of actual or most current adjusted procurement costs to procurement costs estimated at a given baseline, calculated in program base-year dollars. There is one value for each baseline in a program.

Total Program Cost Growth Factor—Refers to the ratio of actual or most current total program costs to total program costs estimated at a given baseline, calculated in program base-year dollars. Procurement costs are adjusted for changes in quantity, and all values are calculated in program base-year dollars.

Ratio R&D/Proc$ (estimate) —Refers to the ratio between RDT&E spending and procurement spending estimates. There is one of these ratios for each baseline in a program: PE, DE, and PdE. The ratios reflect the estimated relative difference between R&D and procurement expenditures at a given baseline.

Ratio R&D/Proc$ (actual)—Refers to the ratio between RDT&E spending and procurement spending at the latest SAR available. There is one of these ratios for each baseline in a program: PE, DE, and PdE. The ratios reflect the relative difference between R&D and procurement expenditures for a given baseline at program completion or the most current SAR. Procurement has been adjusted for changes in quantity.

Baseline Quantity—Refers to the quantity of relevant units (e.g., aircraft, missiles, etc.) estimated at a given baseline.

Current Quantity—Refers to the quantity of relevant units (e.g., aircraft, missiles, etc.) estimated at the latest SAR available.

Quantity Change—Refers to the total value of quantity change between the actual, or most current, estimate and a given baseline in relevant units (e.g., aircraft, missiles, etc.). There is one value for each baseline in a program.

Appendix B
SAR PROGRAMS AND REPORTING STATUS

The following table lists the universe of SAR programs and shows the first and most recent (as of December 1994) SAR submission, and the current reporting status. As explained in the main text, it does not correspond exactly with the number and title of SARs found in the official SAR Summary lists because we have handled certain programs differently for purposes of analysis.

The list is divided into active (currently reporting) and inactive programs. Active programs are labeled as in progress in the status column of Table B.1. Inactive programs are categorized as mature (program complete), terminated (program canceled prior to completion for any of a number of reasons), and below threshold (program dollar amounts fell below SAR reporting threshold).

The 16 programs listed at the end are the programs excluded from our analysis because they did not report costs in constant program base-year dollars. Thus, a cost growth metric consistent with the methodology used here could not be constructed for these programs. Unfortunately, this includes the C-5A, a program that has been cited as having incurred high cost growth.

Table B.1 Status of SAR Programs

PROGRAM	SERVICE	What is It?	Category	1st SAR	Last SAF	STATUS
ACTIVE PROGRAMS COLLECTED (as of Dec 94)						
AAQ-11/12 (LANTIRN)	Air Force	Avionics	Electronic	Dec 82		In progress
AIM-120A (AMRAAM)	Air Force	Air to Air	Missile	Dec 82		In progress
AIM-7M (Sparrow)	Air Force	Air to Air	Missile	Mar 70		In progress
C-130H	Air Force	Cargo	Aircraft	Dec 92		In progress
C-17	Air Force	Cargo	Aircraft	Dec 83		In progress
CPU-97B (Sens Fuzed Weap)	Air Force	Bomb Unit	Munition	Dec 84		In progress
CELV (Titan IV)	Air Force	Launch vehicle	Space	Dec 85		In progress
CMU	Air Force	Tactical Warning	Electronic	Dec 89		In progress
DSCS III	Air Force	Satellite	Space	Dec 76		In progress
DSP	Air Force	Satellite	Space	Dec 83		In progress
E-3A (RSIP)	Air Force	Radar Sys	Electronic	Dec 89		In progress
F-16 (Falcon)	Air Force	Fighter	Aircraft	Dec 75		In progress
F-22(Advanced Tactical Fighter)	Air Force	Fighter	Aircraft	Dec 84		In progress
IUS	Air Force	Launch vehicle	Space	Dec 82		In progress
JDAM	Air Force	INS/GPS warhead app	Munition	Dec 92		In progress
JPATS	Air Force	Training system	Aircraft	Dec 92		In progress
JSIPS	Air Force	Mobile ground station	Electronic	Dec 92		In progress
JSTARS	Air Force	Radar Sys	Electronic	Dec 84		In progress
JTIDS	Air Force	Comm	Electronic	Dec 82		In progress
KC-135R (Stratotanker)	Air Force	Tanker	Aircraft	Dec 82		In progress
KG-44 (DMSP)	Air Force	Satellite	Space	Dec 83		In progress
MILSTAR	Air Force	Satellite	e	Dec 93		In progress
MLV III	Air Force	Launch vehicle	pace	Dec 92		In progress
MMIII GRP	Air Force	Guidance system	Electronic	Dec 93		In progress
NAS	Air Force	Air traffic control	Electronic	Dec 93		In progress
Navstar GPS (Sat.)	Air Force	Satellite	Space	Dec 80		In progress
Navstar GPS (U.E.)	Air Force	Comm	Electronic	Dec 80		In progress
UTTMDS	Air Force	Defense system	Missile	Dec 92		In progress
AAWS-M (Javelin)	Army	Anti-tank Weap	Missile	Sep 89		In progress
ADDS	Army	Comm	Electronic	Dec 83		In progress
AFAS/FAHV	Army	Howitzer system	Munition	Dec 94		In progress
AFATDS	Army	Combat Spt	Electronic	Dec 90		In progress
AGM-114A (Hellfire)	Army	Anti-armor	Missile	Jun 76		In progress
AH-66 (Comanche)	Army	Attack/Scout	Helo	Dec 85		In progress
ASAS/ENSCE	Army	Comm	Electronic	Sep 84		In progress
BAT	Army	Anti-tank submun	Munition	Sep 91		In progress
BFVS A3	Army	Infantry FVS	Vehicle	Dec 93		In progress
BGM-71C/D (TOW II)	Army	Anti-tank	Missile	Dec 83		In progress
CSSCS	Army	Combat Spt	Electronic	Sep 91		In progress
FAAD C2I	Army	Comm	Electronic	Dec 84		In progress
FAADS LOS-R (Avenger)	Army	Air Defense	Missile	Dec 86		In progress
FHTV (PLS)	Army	Loading Sys	Vehicle	Dec 88		In progress
FIM-92C (Stinger-RMP)	Army	Grnd to Air	Missile	Dec 88		In progress
FMTV	Army	Tactical	Vehicle	Dec 88		In progress
JSTARS-GSM	Army	Grnd Station	Electronic	Mar 91		In progress
Longbow Apache-AFM	Army	Airframe mod	Helo	Dec 92		In progress
Longbow Apache-FCR	Army	Fire Control Radar	Electronic	Dec 89		In progress
Longbow Hellfire	Army	Air to Grnd	Missile	Dec 90		In progress
MCS	Army	Manuver Cntrl	Electronic	Dec 91		In progress
MGM-140A (ATACMS)	Army	Ammo	Missile	Sep 84		In progress
MGM-140A (ATACMS/BAT)	Army	Ammo	Missile	Dec 94		In progress
MLRS	Army	Multi-rocket	Munition	Dec 79		In progress

Table B.1 Status of SAR Programs

PROGRAM	SERVICE	What is It?	Category	1st SAR	Last SAR	STATUS
OH-58D (AHIP)	Army	Helo	Electronic	Sep 82		In progress
Patriot P3I	Army	Radar, comm, computer	Electronic	Dec 93		In progress
SADARM	Army	Munitions	Munition	Dec 87		In progress
SCAMP	Army	Satellite	Space	Dec 92		In progress
SINCGARS-V	Army	Comm	Electronic	Dec 83		In progress
SMART-T	Army	Comm avionics	Electronic	Dec 92		In progress
UH-60 (Blackhawk)	Army	Cargo/Transport	Helo	Mar 72		In progress
UH-60L	Army	Cargo/Transport	Helo	Dec 89		In progress
AAAV	Navy	Assault	Vehicle	Dec 92		In progress
AGM-88A (HARM)	Navy	Air to Surf	Missile	Sep 78		In progress
AIM-9X	Navy	IR Ait to Air	Missile	Dec 94		In progress
AN/APS-124 (LAMPS MKIII)	Navy	Combat Sys	Electronic	Jun 76		In progress
AN/BSY-2 SUBACS	Navy	Combat Sys	Electronic	Dec 86		In progress
AN/SQQ-89	Navy	Combat Sys	Electronic	Dec 86		In progress
AOE-6	Navy	Combat Spt	Ship	Dec 88		In progress
AV-8B Remanufacture	Navy	Attack	Aircraft	Dec 94		In progress
BGM-109 (Tomahawk)	Navy	Cruise	Missile	Dec 77		In progress
C/MH-53 (Super Stallion)	Navy	Cargo/Transport	Helo	Jun 73		In progress
CVN 74, 75	Navy	Carrier	Ship	Dec 86		In progress
CVN 76	Navy	Nuclear AC Carrier	Ship	Dec 90		In progress
CVN 77	Navy	Nuclear AC Carrier	Ship	Dec 92		In progress
DDG-51	Navy	Destroyer	Ship	Dec 82		In progress
E-2C Reproduction	Navy	AEW aircraft	Electronic	Dec 94		In progress
EA-6B Upgrade (Prowler)	Navy	Aircraft mod	Electronic	Dec 83		In progress
F-14 Block 1 Strike	Navy	Strike upgrade	Aircraft	Dec 93		In progress
F-14D (Tomcat)	Navy	Fighter	Aircraft	Dec 86		In progress
F/A-18 (Hornet)	Navy	Fighter/Attack	Aircraft	Mar 76		In progress
F/A-18E/F	Navy	Fighter/Attack	Aircraft	Dec 91		In progress
FDS (Fixed Distribution System)	Navy	Comm	Electronic	Dec 86		In progress
JSOW (AIWS)	Navy	Air to Gmd Weapon	Missile	Dec 91		In progress
LCAC-1	Navy	Transport	Ship	Jun 83		In progress
LHD-1	Navy	Amphibious	Ship	Jun 83		In progress
LPD 17 Class	Navy	Transport dock	Ship	Dec 93		In progress
MCM-1	Navy	Minesweeper	Ship	Dec 88		In progress
MHC-51	Navy	Coastal Minehunt	Ship	Dec 91		In progress
MIDS	Navy	Info terminals	Electronic	Dec 92		In progress
MK-15 (Phalanx CIWS)	Navy	Combat Sys	Munition	Dec 82		In progress
MK-48 (ADCAP)	Navy	Torpedo	Missile	Dec 85		In progress
MK-50 (TORPEDO)	Navy	Torpedo	Missile	Jun 83		In progress
MLR	Navy	Med lift Replacement	Aircraft	Dec 93		In progress
NESP	Navy	Comm terminal	Electronic	Dec 92		In progress
NSSN	Navy	Attack submarine	Ship	Dec 94		In progress
RIM-66M,67D (MR/ER)	Navy	IR Seeker	Missile	Dec 83		In progress
SEALIFT	Navy	Strategic sealift	Ship	Dec 92		In progress
SH-60A (CVHELO)	Navy	Helo	Electronic	Dec 85		In progress
SH-60R	Navy	Helo	Electroinc	Dec 94		In progress
SSN-21	Navy	Attack Sub	Ship	Dec 84		In progress
SSN-688	Navy	Attack Sub	Ship	Jun 69		In progress
T-45/TS	Navy	AC Trainer	Aircraft	Dec 83		In progress
T-AGOS	Navy	Surveillience	Ship	Dec 91		In progress
TAO-187 (Fleet Oiler)	Navy	Oiler	Ship	Dec 84		In progress
Trident II (Missile)	Navy	ICBM	Missile	Dec 82		In progress
Trident II (SUB)	Navy	Nuclear Sub	Ship	Dec 82		In progress
UAV	Navy	Various UAVs	Other	Dec 91		In progress

Table B.1 Status of SAR Programs

PROGRAM	SERVICE	What is It?	Category	1st SAR	Last SAR	STATUS
UHF Follow-on	Navy	Satellite	Space	Dec 88		In progress
V-22 (Osprey)	Navy	Amphib VTOL	Helo	Dec 83		In progress
JTUAV	DoD	UAV	Other	Dec 93		In progress
JTUAV (Hunter)	DoD	UAV	Other	Dec 93		In progress
Patriot PAC-3	DoD	Air defense	Missile	Dec 94		In progress
SDS/GPALS	DoD	Mix of Sys Types	Other	Jun 90		In progress
						112
INACTIVE PROGRAMS COLLECTED						
A-10 (Thunderbolt)	Air Force	Attack AC	Aircraft	Jun 71	Mar 82	Mature
A-7D (Corsair II)	Air Force	Attack AC	Aircraft	Dec 69	Jun 75	Mature
AGM-131A (SRAM II)	Air Force	Std-off Air to Surf	Missile	Dec 85	Dec 91	Terminated
AGM-131A (SRAM-T)	Air Force	Std-off Air to Surf	Missile	Dec 90	Dec 91	Terminated
AGM-134 (SICBM)	Air Force	ICBM	Missile	Dec 85	Dec 91	Terminated
AGM-136A (Tacit Rainbow)	Air Force	Seeker Kill	Missile	Jun 87	Dec 90	Terminated
AGM-65A (Maverick TV)	Air Force	Air to Grnd	Missile	Mar 69	Sep 76	Mature
AGM-65C (Maverick Laser)	Air Force	Air to Grnd	Missile	Dec 76	Dec 78	Terminated
AGM-65D (Maverick)	Air Force	Air to Grnd	Missile	Jun 75	Dec 92	Mature
AGM-69A (SRAM)	Air Force	Stand-off	Missile	Jun 69	Nov 74	Mature
AGM-86B (ALCM)	Air Force	Cruise	Missile	Sep 79	Dec 85	Mature
AGM-88A (HARM)	Air Force	Air to Surf	Missile	Sep 79	Dec 86	Mature
AIM-129A (ACM)	Air Force	Cruise	Missile	Dec 89	Dec 92	Mature (terminated)
AIM-9L (Sidewinder)	Air Force	Air to Air	Missile	Jun 73	Sep 80	Mature
AIM-9M (Sidewinder)	Air Force	Air to Air	Missile	Dec 80	Dec 83	Mature
AN/FPS-118 (OTH-B)	Air Force	Radar	Electronic	Dec 83	Dec 90	Terminated
ASM-135A (ASAT)	Air Force	Anti-Sat	Missile	Dec 83	Dec 87	Terminated
ATARS	Air Force	Avionics	Electronic	Dec 87	Dec 88	Terminated
B-1A	Air Force	Bomber	Aircraft	Dec 69	Dec 78	Terminated
B-1B (Lancer)	Air Force	Bomber	Aircraft	Dec 81	Dec 92	Mature
B-52 (OAS/CMI)	Air Force	Avionics	Electronic	Dec 82	Dec 84	Mature
BGM-109G (GLCM, Gryphon)	Air Force	Cruise	Missile	Dec 77	Dec 88	Mature
C-5B (Galaxy)	Air Force	Cargo	Aircraft	Jun 83	Dec 88	Mature
CIS (MARK XV IFF)	Air Force	Comm	Electronic	Dec 84	Dec 90	Terminated
CSRL	Air Force	Launcher	Other	Dec 85	Dec 88	Mature
E-3A (AWACS, Sentry)	Air Force	Surveill.	Electronic	Mar 70	Jun 84	Mature
E-4 (AABNCP NEACP)	Air Force	Comm	Electronic	Mar 73	Mar 82	Mature
EF-111A (Raven)	Air Force	Comm	Electronic	Mar 76	Dec 83	Mature
Enhanced JTIDS	Air Force	Comm	Electronic	Dec 83	Dec 85	Terminated
F-111 A/D/E/F	Air Force	Fighter	Aircraft	Mar 69	Jun 75	Mature
F-15 (Eagle)	Air Force	Fighter	Aircraft	Mar 69	Dec 90	Mature
F-5E (Tiger II)	Air Force	Fighter	Aircraft	Jun 71	Mar 76	Mature
FEWS	Air Force	Satellite	Space	Dec 92	Dec 92	Terminated
HH-60D (Night Hawk)	Air Force	Helo	Helo	Jun 83	Sep 84	Below threshold
I-SA (AMPE\	Air Force	Comm	Electronic	Mar 84	Dec 87	Terminated
KC-10A (Extender\	Air Force	Tanker	Aircraft	Jun 83	Dec 86	Mature
Laser Bomb Guidance	Air Force	Avionics	Electronic	Dec 83	Dec 84	Below threshold
LGM-118A (Peacekeeper)	Air Force	ICBM	Missile	Jun 83	Dec 92	Mature
LGM-30G (Minuteman III)	Air Force	ICBM	Missile	Jun 69	Mar 78	Mature
MLS	Air Force	Avionics	Electronic	Dec 84	Sep 89	Terminated
PLSS	Air Force	Avionics	Electronic	Mar 78	Jun 86	Terminated (twice)
Rail Garrison	Air Force	Launcher	Other	Dec 86	Dec 91	Terminated
T-46A (Next Gener. Train.)	Air Force	AC Trainer	Aircraft	Jun 83	Dec 86	Terminated
UXC-4 (TRI-TAC)	Air Force	Comm	Electronic	Dec 83	Dec 89	Below threshold
WWMCCS (WIS)	Air Force	Comm	Electronic	Dec 83	Dec 90	Unknown

Table 3.1 Status of SAR Programs

PROGRAM	SERVICE	What is It?	Category	1st SAR	Last SAR	STATUS
AGM-136A (JGLTacitRnbw)	Army	Grnd Launch	Missile	Dec 90	Dec 90	Terminated
AH-64 (Apache)	Army	Attack	Helo	Dec 74	Dec 91	Mature
AN/GSG-10 (TACFIRE)	Army	Comm	Electronic	Jun 71	Dec 81	Mature
AN/TTC-39	Army	Comm	Electronic	Sep 74	Dec 84	Mature
AN/USQ-34 (SOTAS)	Army	Comm	Electronic	Sep 78	Dec 81	Terminated
ARVS (Scout)	Army	Armored	Vehicle	Mar 70	Dec 74	Terminated
ASM	Army	Armored Sys	Vehicle	Jun 90	Dec 91	Unknown
ATCCS/CHS	Army	Comm	Electronic	Dec 88	Dec 89	Below threshold
BGM-71A (TOW)	Army	Anti-tank	Missile	Jun 71	Mar 77	Mature
CH-47D (Chinook)	Army	Cargo/Transport	Helo	Jun 78	Dec 92	Mature
FAADS LOS-F-H (ADATS)	Army	Air Defense	Missile	Dec 86	Dec 91	Terminated
FAADS NLOS (FOG-M)	Army	Air Defense	Missile	Dec 86	Dec 91	Below threshold
FGM-77A (Dragon)	Army	Anti armor	Missile	Jun 71	Dec 77	Mature
FIM-92A/B (Stinger/Stinger-Post)	Army	Grnd to Air	Missile	Jun 73	Sep 89	Mature
HLH	Army	Helo	Helo	Dec 71	Sep 75	Terminated
JTIDS	Army	Comm	Electronic	Sep 82	Dec 85	Transferred to AF
JTMD/ATM	Army	Missile Def	Missile	Dec 87	Dec 88	Below threshold
LAV	Army	Light armor	Vehicle	Dec 82	Dec 83	Terminated
M-1 (Abrams)	Army	Tank	Vehicle	Sep 73	Dec 91	Mature
M-109 (Howitzer)	Army	Howitzer	Munition	Sep 84	Sep 84	Below threshold
M-198 (Howitzer)	Army	Howitzer	Munition	Dec 75	Mar 81	Mature
M-2/3 (Bradley FVS)	Army	APV	Vehicle	Mar 73	Dec 92	Mature
M-60A2 Tank	Army	Tank	Vehicle	Jun 69	Mar 74	Mature
M-712 (Copperhead)	Army	Munitions	Munition	Sep 75	Dec 88	Mature
M-988 (DIVAD Sgt York)	Army	Air Defense	Munition	Mar 78	Oct 85	Terminated
MGM-131B (Pershing II)	Army	Int. range nuclear	Missile	Mar 79	Sep 87	Mature
MGM-50 (Lance)	Army	Short range	Missile	Mar 69	Dec 77	Mature
MIM-104 (Patriot)	Army	Air Defense	Missile	Jun 76	Dec 91	Mature
MIM-115 (Roland)	Army	Air Defense	Missile	Jun 75	Mar 82	Mature
MIM-23B (Improved Hawk)	Army	Air defense	Missile	Jun 71	Sep 78	Mature
MLRS/TGW	Army	Multi-rocket	Munition	Dec 84	Dec 91	Below threshold
MSE	Army	Comm	Electronic	Dec 85	Dec 92	Mature
RPV	Army	Air target	Other	Dec 83	Dec 87	Terminated
Safegaurd	Army	ADM	Missile	Mar 69	Sep 74	Terminated
Stingray	Army	Laser optical jam	Electronic	Sep 91	Dec 91	Unknown
5" Guided Projectile	Navy	Projectile	Munition	Jun 78	Dec 81	Terminated
8" Guided Projectile	Navy	Projectile	Munition	Mar 78	Dec 78	Terminated
A-6E/F (Intruder)	Navy	Attack	Aircraft	Dec 83	Dec 88	Mature
A-7E (Corsair II)	Navy	Attack	Aircraft	Jun 69	Jun 78	Mature
AAAM	Navy	Air to Air	Missile	Sep 91	Dec 91	Terminated
Aegis Mk 7	Navy	Combat Sys	Electronic	Jun 70	Dec 79	Mature
AFX	Navy	Multi-role fighter	Aircraft	Dec 92	Dec 92	Terminated
AGM-53A (Condor)	Navy	Stand-off	Missile	Mar 69	Mar 77	Terminated
AGM/RGM/UGM-84A (HARPOON)	Navy	Anti-ship	Missile	Sep 71	Dec 91	Mature
AIM-54A (Phoenix)	Navy	Air to Air	Missile	Jun 69	Dec 81	Mature
AIM-54C (Phoenix)	Navy	Air to air	Missile	Jun 82	Dec 91	Mature
AIM-7M (Sparrow)	Navy	Air to Air	Missile	Dec 80	Dec 89	Mature
AIM-9L (Sidewinder)	Navy	Air to Air	Missile	Jun 73	Sep 80	Mature
AIM-9M (Sidewinder)	Navy	Air to Air	Missile	Dec 80	Dec 83	Below threshold
AN/ALQ-165 (ASPJ)	Navy	Avionics	Electronic	Dec 83	Dec 92	Terminated
AN/BSY-1/2 (SUBACS comb)	Navy	Combat Sys	Electronic	Dec 83	Dec 92	Mature
AN/SQR-19 (TACTAS)	Navy	Comm	Electronic	Jun 77	Dec 85	Mature
AN/SQY-1	Navy	Combat Sys	Electronic	Sep 90	Dec 91	Terminated
AN/TPS-71 (ROTHR)	Navy	Radar	Electronic	Jun 90	Mar 91	Terminated

Table B.1 Status of SAR Programs

PROGRAM	SERVICE	What is It?	Category	1st SAR	Last SAR	STATUS
AQM-127A (SLAT)	Navy	Air Target	Other	Dec 88	Dec 91	Mature
ASWSOW (Sea Lance)	Navy	Anti-Sub Wpn	Missile	Dec 83	Dec 89	Terminated
AV-8B (Harrier II)	Navy	Attack	Aircraft	Jun 81	Dec 92	Mature
Battleship React.	Navy	Battleship	Ship	Dec 82	Dec 88	Mature
CG-47 (Aegis Cruiser)	Navy	Cruiser	Ship	Jun 78	Dec 92	Mature
CGN-38	Navy	Cruiser	Ship	Mar 69	Dec 79	Mature
CVN 68, 69, 70	Navy	Carrier	Ship	Mar 69	Dec 79	Mature
CVN 71	Navy	Carrier	Ship	Mar 80	Dec 86	Mature
CVN 72, 73	Navy	Carrier	Ship	Dec 81	Dec 91	Mature
DD-963 (Destroyer)	Navy	Destroyer	Ship	Mar 69	Sep 79	Mature
E-2C (Hawkeye)	Navy	Surveillance ac	Electronic	Dec 84	Dec 91	Mature
E-6 Air Comm (Hermes)	Navy	Comm	Electronic	Jun 83	Dec 91	Mature
EMSP	Navy	Signal processor	Electronic	Dec 91	Dec 92	Below threshold
F-14A (Tomcat)	Navy	Fighter	Aircraft	Jun 69	Dec 86	Mature
FFG 7	Navy	Frigate	Ship	Mar 73	Sep 87	Mature
HFAJ System	Navy	Comm	Electronic	Sep 87	Dec 87	Terminated
JTIDS DTDMA	Navy	Comm	Electronic	Jun 82	Dec 85	Terminated
LHA (Assault Ship)	Navy	Amphib	Ship	Mar 69	Sep 79	Mature
Light Armored Vehicle	Navy	Light Armor	Vehicle	Dec 82	Dec 83	Below threshold
LSD-41 (Basic)	Navy	Assault	Ship	Jun 83	Dec 90	Mature
LSD-41 (Cargo Variant)	Navy	Cargo	Ship	Sep 87	Dec 91	Below threshold
MK-48 (TORPEDO)	Navy	Torpedo	Missile	Mar 69	Sep 79	Mature
MK-60 (Captor)	Navy	Mine/torpedo	Munition	Dec 75	Dec 83	Mature
NATO AAWS	Navy	Combat Sys	Other	Dec 88	Dec 90	Terminated
NATO PHM (Hydrofoil)	Navy	Fast Patrol	Ship	Mar 73	Mar 82	Mature
P-3C (Orion)	Navy	ASW Patrol	Electronic	Sep 69	Jun 81	Mature
P-3C Mod (Orion)	Navy	ASW Patrol	Electronic	Dec 83	Dec 89	Mature
P-7A (LRAACA)	Navy	ASW	Aircraft	Dec 88	Sep 90	Terminated
S-3A (Viking)	Navy	Anti-Sub	Aircraft	Mar 69	Mar 77	Mature
SURTASS	Navy	Comm	Electronic	Dec 75	Sep 81	Below threshold
UGM-133A (Trident II)	Navy	ICBM	Missile	Dec 71	Dec 83	Mature
UGM-96A (Trident I)	Navy	Nuclear Sub	Ship	Dec 71	Dec 83	Mature
VAST	Navy	Test Equip	Electronic	Jun 71	Dec 74	Mature

INACTIVE PROGRAMS NOT COLLECTED DUE TO ABSENCE OF BASE YEAR DATA

C-5A	Air Force	Cargo	Aircraft	Mar 69	Sep 73	Mature
DSCS II	Air Force	Satellite	Space	Jun 71	Dec 71	Mature
FB-111A	Air Force	Fighter	Aircraft	Mar 69	Sep 71	Mature
Minuteman II	Air Force	ICBM	Missile	Jun 69	Sep 73	Mature
Cheyenne (AH-56)	Army	Helo	Helo	Jun 69	Mar 73	Terminated
MBT-XM803	Army	Tank	Vehicle	Jun 69	Sep 71	Terminated
Shillelagh Missile	Army	Direct fire	Missile	Dec 69	Jun 71	Mature
AN/BQQ-5	Navy	Comm	Electronic	Mar 72	Dec 73	?
AN/BQS-13 DNA	Navy	Comm	Electronic	Jun 71	Dec 71	?
AN/SQQ-23	Navy	Comm	Electronic	Jun 71	Jun 71	?
AV-8A	Navy	Attack	Aircraft	Jun 71	Dec 73	Mature
DE 1052 Escort	Navy	Escort	Ship	Mar 72	Mar 72	Mature
DLG AAW Mod	Navy	Frigate	Electronic	Jun 71	Jun 71	Mature
Poseidon	Navy	Sub/ICBM	Missile	Mar 69	Jun 75	Mature
SSN-637 Sturgeon	Navy	Sub	Ship	Jun 71	Mar 72	Mature
SSN-685	Navy	Sub	Ship	Jun 71	Jun 71	Mature

Appendix C
WEAPON SYSTEM CLASSIFICATION

Table C.1 provides the weapon system classification for each program in the database and a brief rationale for that designation. In most cases, determining system type is straightforward. However, in some cases, we deviated from the obvious for the reasons shown.

The munitions category includes munitions, howitzers, and gun systems. Munitions are distinguished from missiles in that they either are not self-propelled or have no guidance unit. Missiles are self-propelled and have a guidance unit. Torpedoes are included in the missile category. Vehicles are self-propelled, hence trailers are not vehicles. Space systems include both launch vehicles and satellites. "Other" includes rail garrison basing, drones, unmanned aerial vehicles, rotary launchers, and Strategic Defense System. Electronics encompasses all electronics-based systems, including avionics, sonar and towed arrays, and communication systems. Aircraft programs whose primary motivation is electronics and that do not involve a new airframe are categorized as electronic systems. These include B-52 OAS/CMI, P-3C mods, OH-58D, LAMPS MK III, EF-111A, E-3A AWACS, E-4A, EA-6B upgrade, P-3C, E-8A JSTARS, E-2C, and SH-60F CV Helo. A similar logic is applied to ships (e.g., the DGL AAW Mod is categorized as electronics).

Many of the classifications are subjective. Some programs are mixtures, such as the Navstar Global Positioning System, which includes satellites, control systems, and user equipment. Other programs, such as the V-22 (helicopter rather than aircraft) and CAPTOR (munition rather than missile/torpedo) simply fall into gray areas.

Table C.1 Weapon System Classification

WEAPON TYPE DESIGNATION LIST (as of Dec 94 SAR)

Program	Service	Weapon Type	Description
A-10 (Thunderbolt)	Air Force	Aircraft	Close air support aircraft
A-7D (Corsair II)	Air Force	Aircraft	Close air support and interdiction aircraft
AAQ-11/12 (LANTIRN)	Air Force	Electronic	Low Altitude Navigation and Targeting Infrared System for Night (EO fire control system)
AGM-131 (SRAM II)	Air Force	Missile	Short Range Attack Missile (improved nuclear air-to-surface missile replacing the AGM-69A
AGM-131A (SRAM-T)	Air Force	Missile	Nuclear Air to Surface
AGM-134 (SICBM)	Air Force	Missile	Small ICBM; hard mobile system
AGM-136A (Tacit Rainbow)	Air Force	Missile	Air-launched, loitering, antiradiation missile
AGM-65A (Maverick TV)	Air Force	Missile	TV-guided air-to-surface missile
AGM-65C (Maverick Laser)	Air Force	Missile	Laser-guided air-to-surface missile
AGM-65D (Maverick)	Air Force	Missile	Imaging infrared version of Maverick air-to-ground missile
AGM-69A (SRAM)	Air Force	Missile	Short Range Attack Missile; supersonic air-to-surface missile armed with nuclear warhead
AGM-86B (ALCM)	Air Force	Missile	Air-Launched Cruise Missile
AGM-88A (HARM)	Air Force	Missile	High speed Anti-Radiation Missile; air-to-surface missile designed to destroy enemy radars
AIM-120A (AMRAAM)	Air Force	Missile	Advanced Medium Range Air-to Air Missile (Sparrow replacement)
AIM-129A (ACM)	Air Force	Missile	Cruise missile
AIM-7M (Sparrow)	Air Force	Missile	All weather, air-to-air missile
AIM-9L (Sidewinder)	Air Force	Missile	Infrared seeking, air-to-air missile
AIM-9M (Sidewinder)	Air Force	Missile	Infrared seeking, air-to-air missile
AN/FPS-118 (OTH-B)	Air Force	Electronic	Over-the-Horizon Backscatter Radar
ASM-135A (ASAT)	Air Force	Missile	Anti-Satellite missile; modified SRAM first stage plus Altair III second stage with miniature imaging infrared homing warhead vehicle
ATARS	Air Force	Electronic	Advanced Tactical Air Reconnaissance System; focuses on development of a common systems for manned and unmanned reconaissance family of EO/IR sensor suites, datalink sets, recorders, and recon management
B-1A (Bomber)	Air Force	Aircraft	Strategic bomber
B-1B (Lancer)	Air Force	Aircraft	Strategic bomber
B-52 (OAS/CMI, Stratofort.)	Air Force	Electronic	Offensive Avionics System/Cruise Missile (ALCM) Integration
BGM-109G (GLCM, Gryphon)	Air Force	Missile	Mobile surface-to-surface intermediate range nuclear missile; Ground Launched Cruise Missile
* C-130H	Air Force	Aircraft	Cargo (improved version of C-130E)
C-17	Air Force	Aircraft	Transport
C-5B (Galaxy)	Air Force	Aircraft	Transport aircraft (improved version of C-5A)
CBU-97B (Sens Fuzed Weap)	Air Force	Munition	CBU-97/B: consists of ten BLU-108/B submunitions packaged within Tactical Munition Dispenser (TMD); within each BLU-108/B are four self-forging, fragment warheads commonly called "skeets"
CELV (Titan IV)	Air Force	Space	Complementary Expendable Launch Vehicle (upgraded Titan 34D)
CIS (MARK XV IFF)	Air Force	Electronic	Combat Identification System (Identification Friend or Foe)
CMU	Air Force	Electronic	Cheyenne Mountain Upgrade (mix of subsystems)
CSRL	Air Force	Other	Common Strategic Rotary Launcher
DSCS III	Air Force	Space	Defense Satellite Communication System (secure voice and high rate data transmission)
DSP	Air Force	Space	Defense Support Program (satellite in geostationary orbit plus ground support equipment for monitoring ballistic missile activity and provide warning of attack)
E-3A (AWACS, Sentry)	Air Force	Electronic	Airborne Warning and Control System; modified 707 airframe
E-3A (RSIP)	Air Force	Electronic	Radar System Improvement Program
E-4 (AABNCP NEACP)	Air Force	Electronic	Advanced Airborne Command Post; modified 747
EF-111A (TJS Raven)	Air Force	Electronic	Tactical Jamming System; modified F-111A airframe
F-111 A/D/E/F	Air Force	Aircraft	Tactical fighter
F-15 (Eagle)	Air Force	Aircraft	Air superiority fighter
F-16 (Falcon)	Air Force	Aircraft	Multimission fighter
F-22 (ATF, Advanced Tactical Fighter)	Air Force	Aircraft	Air superiority fighter
F-5E (Tiger II)	Air Force	Aircraft	Air superiority fighter
* FEWS	Air Force	Space	Follow on Early Warning System (satellite)
HH-60D (Night Hawk)	Air Force	Helo	Combat search and rescue/special operations helicopter
I-SA (AMPE)	Air Force	Electronic	Inter-Service/Agency Automated Message Processing Exchange
IUS	Air Force	Space	Inertial Upper Stage (upper stage for Titan III and Shuttle)
* JDAM	Air Force	Munition	Joint Direct Attack Munition (INS/GPS for warhead application)
* JPATS	Air Force	Aircraft	Joint Primary Aircraft Training System
* JSIPS	Air Force	Electronic	Joint Service Imagery Processing System (mobile ground station)
JSTARS	Air Force	Electronic	Joint Surveillance and Target Attack Radar System (battle management and targeting system using modified 707 acft to be called E-8A)
JTIDS	Air Force	Electronic	Joint Tactical Information Distribution System (advanced jam-resistant, computerized radio

Table C.1 Weapon System Classification

	JTIDS (Enhanced EJS)	Air Force	Electronic	Program to develop a high anti-jam resistant voice communication system to
	KC-10A (Extender)	Air Force	Aircraft	Tanker/cargo aircraft (modified DC-10)
	KC-135R (Stratotanker)	Air Force	Aircraft	Tanker aircraft (modified KC-135A incorporating new engines, pylons, nacelles)
	KG-44 (DMSP)	Air Force	Space	Defense Meteorological Satellite Program (Block 5D)
	Laser Bomb Guidance	Air Force	Electronic	Low Level Laser Bomb Guidance Kit (aka Paveway III); consists of laser bomb guidance kit
	Laser Bomb Guidance	Air Force	Electronic	attached to MK-82 (GBU-22) or MK-84 (GBU-24) bomb
	LGM-118A (Peacekeeper)	Air Force	Missile	ICBM (also known as MX) that is currently silo-based
	LGM-30G (Minuteman III)	Air Force	Missile	Three stage, solid propellant ICBM
*	MILSTAR	Air Force	Space	Milstar Satellite Communications Systems (satellites/terminals)
	MLS	Air Force	Electron	Microwave landing system, precision approach radar
*	MMIII GRP	Air Force	Electronic	Minuteman III Guidance Replacement Program
*	MLV III	Air Force	Space	Medium Launch Vehicle III (rocket)
	NAS	Air Force	Electronic	National Airspace System. Modernization of DoD air traffic control systems.
	Navstar GPS	Air Force	Space	Navigation Satellite Timing and Ranging Global Positioning System
	PLSS	Air Force	Electronic	Precision Locating Strike Systems
	Rail Garrison	Air Force	Other	Program to enhance the survivability of the ICBM system by deploying Peacekeepers on train using nation's mainline rail network (includes trains and alert shelters for trains)
	T-46A (Next Gener. Train.)	Air Force	Aircraft	Training aircraft for UPT (aka Next Generation Trainer or NGT)
*	UTTMDS	Air Force	Missile	Upper Tier Theater Missile Defense System (ground based radar/fire control sensor)
	UXC-4 (TRI-TAC)	Air Force	Electronic	Joint Tactical Communications Program (tactical multi-channel switched communications including AN/TRC-170 digital tropscopic radio terminals and the Communications Nodal Control Element (CNCE))
	WWMCCS (WIS)	Air Force	Electronic	World Wide Military Command and Control System
	AAWS-M (Javelin)	Army	Missile	Anti-tank Weapon System
	ADDS	Army	Electronic	Army Data Distribution System (hybrid of PLRS (Position Locating Reporting System) and JTI
	AFAS/FARV	Army	Munition	Fire support system. Includes howitzer, resupply vehicle, and AFAS.
	AFATDS	Army	Electronic	Battlefield Management and Decision Support System
	AGM-114A (Hellfire)	Army	Missile	Helicopter-launched air-to-surface terminal homing missile with variety of seeker modules
	AGM-136A (JGLTactRnbw)	Army	Missile	Joint Service Munition
	AH-64 (Apache)	Army	Helo	Attack helicopter equipped with night and adverse weather capability
	AH-66 (Comanche)	Army	Helo	Helicopter to fulfil Army's armed reconnaisance/light attack mission
	AN/GSG-10 (TACFIRE)	Army	Electronic	TACtical FIRE direction System (integrated on-line tactical computer system for use by field artillery units)
	AN/TTC-39	Army	Electronic	Circuit switch
	AN/USQ-84 (SOTAS)	Army	Electronic	StandOff Target Acquisition System; consists of airborne surveillance and target acquisition radar (mounted in EH-60C) plus datalink to ground
	ARVS (Scout)	Army	Vehicle	Armed Reconnaisance Vehicle
	ASAS/ENSCE	Army	Electronic	All Source Analysis System/Enemy Situation Correlation Element (ASAS is the control subsys for the Intelligence/Electronic Warfare subsystem of the Army Command and Control System
	ASM	Army	Vehicle	Armored System Modernization
	ATCCS/CHS	Army	Electronic	Army Tactical Command and Control System - Common Hardware/Software
	BAT	Army	Munition	Anti-tank submunition, top attack
	BFVS A3	Army	Vehicle	Bradley FVS upgrade.
	BGM-71A (TOW)	Army	Missile	Tube launched, Optically tracked, Wire guided surface-to-surface and air-to-surface missile
	BGM-71C/D (TOW II)	Army	Missile	Tube launched, Optically tracked, Wire guided surface-to-surface and air-to-surface missil
	CH-47D (Chinook)	Army	Helo	Medium transport helicopter
	CSSCS	Army	Electronic	Combat Support
	FAAD C2I	Army	Electronic	Forward Area Air Defense Command, Control, and Intelligence; C2I network tying FAADS weapons together
	FAADS LOS-F-H (ADATS)	Army	Missile	Forward Area Air Defense System Line of Sight-Forward-Heavy; ADATS = Air Defense Anti-Tank System; laser beamrider missile; replacement for Sgt York; mounted on Bradley FVS
	FAADS LOS-F (Avenger)	Army	Missile	Forward Area Air Defense System Line of Sight-Rear; aka PMS or Pedestal Mounted Stinger; to be launched from High Mobility Multipurpose Wheeled Vehicle
	FAADS NLOS (FOG-M)	Army	Missile	Forward Area Air Defense System Non-Line of Sight; FOG-M = Fiber Optic Guided Missile; to be launched from either High Mobility Multipurpose Vehicle or MLRS Vehicle
	FGM-77A (Dragon)	Army	Missile	Medium range, wire guided antitank missile
	FHTV (PLS)	Army	Vehicle	Family of Heavy Tactical Vehicles (Palletized Loading System); PLS is 16.5 ton vehicle composed of prime mover with integral self-load/unload capability plus 16.5 ton trailer
	FIM-92A/B (Stinger/Stinger-Post)	Army	Missile	Man portable, shoulder fired surface-to-air missile in disposable launch tube
	FIM-92C (Stinger-RMP)	Army	Missile	Stinger Re Multiprocessor
	FMTV	Army	Vehicle	Family of Medium Tracked Vehicles; 2.5 to 5 ton vehicles suited for multipurpose transport
	HLH	Army	Helo	Heavy Lift Helicopter
	JSTARS-GSM	Army	Electronic	Ground stations for JSTARS
	JTIDS	Army	Electronic	Joint Tactical Information Distribution System

Table C.1 Weapon System Classification

JTMD/ATM	Army	Missile	Joint Tactical Missile Defense Program/Anti-Tactical Missile; JTMD is umbrella concept under which technologies to support active defense, counterforce, passive countermeasure and command and control systems against Warsaw Pact tactical missile threat; initial focus is on providing self defense of Patriot via Anti-Tactical Missile (ATM)
LAV	Army	Vehicle	Light Armored Vehicle
* Longbow Apache AFM	Army	Helo	Air Frame Modifications
* Longbow Apache FCR	Army	Electronic	Fire Control Radar
Longbow Hellfire	Army	Missile	Air to Ground
M-1 (Abrams)	Army	Vehicle	Four man, highly mobile, fully tracked vehicle
M-109 (Howitzer)	Army	Munition	Self propelled howitzer
M-198 (Med. Tow Howitzer)	Army	Munition	155mm Medium Towed Howitzer
M-2/3 (Bradley FVS)	Army	Vehicle	Fully tracked, lightly armored infantry and calvary vehicle
M-26 (MLRS)	Army	Munition	Multiple Launch Rocket System; artillery rocket system on M-270 launch vehicle
M-60A2 Tank	Army	Vehicle	Diesel powered combat tank
M-712 (Copperhead)	Army	Munition	Cannon launched 155mm guided projectile (homes on laser beam projected on target by forward observer)
M-998 (DIVAD Sgt York)	Army	Munition	DIVision Air Defense gun system; combines twin 40mm guns with sophisticated fire control system; chassis to have been modified M48S tank
MCS	Army	Electronic	Manuever Control System
MGM-131B (Pershing II)	Army	Missile	Mobile, intermediate range ballistic missile with nuclear warhead
MGM-140A (ATACMS)	Army	Missile	Army Tactical Missile System (improved conventional missile designed to attack targets by range of cannons and rockets; to be fired from M270 (MLRS) launcher)
MGM-140A (ATACMS/BAT)	Army	Missile	BAT submunition program merge with ATACMS
MGM-50 (Lance)	Army	Missile	
MIM-104 (Patriot)	Army	Missile	Surface-to-air missile that provides medium to high altitude air defense
* MIM-104 (Patriot P3I)	Army	Electronic	Improvement program to upgrade Patriot system performance
MIM-115 (Roland)	Army	Missile	Short range surface-to-air missile with vehicle mounted fire unit; European-designed
MIM-23B (Improved Hawk)	Army	Missile	Medium range air defense missile against low to medium altitude aircraft
MLRS/TGW	Army	Munition	Multiple Launch Rocket System/Terminally Guided Warhead
MSE	Army	Electronic	Mobile Subscriber Equipment; automatic switched digital secure voice and data transmission for corps and division users
OH-58D (AHIP)	Army	Electronic	Advanced Helicopter Improvement Program (modified OH-58A with TV, thermal imaging, and laser rangefinder-designator)
RPV	Army	Other	Aquila; small propeller driven, automatically controlled pilotless aircraft for target acquisition, designation, reconnaissance, and damage assessment
SADARM	Army	Munition	Sense and Destroy Armor; munition to provide enhanced counterbattery capability for 155mm howitzer and the MLRS
Safeguard	Army	Missile	Sprint and the high altitude Spartan
* SCAMP	Army	Space	Single Channel Anti-Jam Manportable Terminal (satellite terminals)
SINCGARS-V	Army	Electronic	Single Channel Ground and Airborne Radio System (VHF-FM combat net radio)
* SMART-T	Army	Electronic	Secure Mobile Anti-Jam Reliable Tactical Terminal (communications avionics)
Stingray	Army	Electronic	Electro-optical countermeasures system
UH-60 (Blackhawk)	Army	Helo	Utility helicopter formerly called UTTAS (Utility Tactical Transport Aircraft System)
UH-60L	Army	Helo	Engine upgrade to UH-60A. Reported as part of UH-60A SAR.
5" Guided Projectile	Navy	Munition	Semi-active laser guided projectile
8" Guided Projectile	Navy	Munition	Family of gun launched terminal homing 8" projectiles capable of target lockon
A-6E/F (Intruder)	Navy	Aircraft	Carrier based r k aircraft (ship and land targets)
A-7E (Corsair II)	Navy	Aircraft	Carrier based c se air support and interdiction aircraft
AAAM	Navy	Missile	Advanced Air to Air Missile
AAAV	Navy	Vehicle	Advanced Amphibious Assault Vehicle
Aegis Mk 7	Navy	Electronic	Anti-air defense system using advanced concept radar system and armed with Standard missile
* AFX	Navy	Aircraft	Multi-role fighter
AGM-53A (Condor)	Navy	Missile	Standoff, air-to-surface, EO guided missile
AGM-88A (HARM)	Navy	Missile	High speed Anti-Radiation Missile; air-to-surface missile designed to destroy enemy radars
AGM/RGM/UGM-84A (HARPOON)	Navy	Missile	Air/ship/submarine launched anti-ship missile
AIM-120A (AMRAAM)	Navy	Missile	Advanced Medium Range Air-to Air Missile (Sparrow replacement)
AIM-54A (Phoenix)	Navy	Missile	Air-to-air, all weather long range missile
AIM-54C (Phoenix)	Navy	Missile	Air-to-air, all weather long range missile with improved perf and reliability over AIM-54A
AIM-7M (Sparrow)	Navy	Missile	All weather, air-to-air missile
AIM-9L (Sidewinder)	Navy	Missile	Infrared seeking, air-to-air missile
AIM-9M (Sidewinder)	Navy	Missile	Infrared seeking, air-to-air missile
AIM-9X	Navy	Missile	Infrared seeking, air-to-air missile
AN/ALQ-165 (ASPJ)	Navy	Electronic	Airborne Self Protection Jammer (defensive ECM for tactical aircraft)

Table C.1 Weapon System Classification

AN/APS-124 (LAMPS MKIII)	Navy	Electronic	Light Airborne Multi-Purpose System; computer integrated ship/helicopter system; the aircraft subsystem is the SH-60B Seahawk (a derivative of the UH-60)
AN/BSY-1/2 (SUBACS comb)	Navy	Electronic	SUBmarine Advanced Combat Information System; AN/BSY-1 for Los Angeles class attack submarines plus AN/BSY-2 for Seawolf class attack submarine
AN/BSY-2 (SUBACS)	Navy	Electronic	SUbmarine Advanced Combat Information System for Seawolf class attack submarine
AN/SQQ-89	Navy	Electronic	Surface Ship ASW Combat System (provides surface ships with capability to detect, classify, and track enemy subs at long range)
AN/SQR-19 (TACTAS)	Navy	Electronic	TACtical Towed Array Sensor
AN/SQY-1	Navy	Electronic	Combat system
AN/TPS-71 (ROTHR)	Navy	Electronic	Relocatable over-the-horizon radar
AOE-6	Navy	Ship	Fast combat support ship (delivers ammo, fuel, and provisions to battle groups)
AQM-127A (SLAT)	Navy	Other	Supersonic Low Altitude Target; supersonic, remotely controlled, recoverable target vehicle
ASWSOW (Sea Lance)	Navy	Missile	UUM-125A; Anti-Submarine Warfare Standoff Weapon; SUBROC replacement
AV-8B (Harrier II)	Navy	Aircraft	Improved version of AV-8A V/STOL, light attack, close air support aircraft
AV-8B Remanufacture	Navy	Aircraft	Converts older AV-8B models to most recent production configuration
Battleship React.	Navy	Ship	Reactivation of battleships New Jersey, Iowa, Missouri, and Wisconsin
BGM-109 (Tomahawk)	Navy	Missile	Ship/submarine launched land attack and anti-ship missile (formerly called SLCM or Sea Launched Cruise Missile)
C/MH-53 (Super Stallion)	Navy	Helo	Shipboard compatible, heavy transport helicopter
CG-47 (Aegis Cruiser)	Navy	Ship	Ticonderoga class cruiser fitted with Aegis combat system
CGN-38	Navy	Ship	Virginia class nuclear powered guided missile cruiser
CVN 68, 69, 70	Navy	Ship	Nimitz class nuclear powered carriers
CVN 71	Navy	Ship	Nimitz class nuclear powered carrier
CVN 72, 73	Navy	Ship	Nimitz class nuclear powered carriers
CVN 74, 75	Navy	Ship	Nimitz class nuclear powered carriers
CVN-76	Navy	Ship	Nuclear Aircraft Carrier
* CVN-77	Navy	Ship	Nuclear Aircraft Carrier
DD-963 (Destroyer)	Navy	Ship	Spruance class destroyer
DDG-51	Navy	Ship	Burke class guided missile destroyer
E-2C (Hawkeye)	Navy	Electronic	Carrier-based early warning, strike control and surveillance aircraft
E-2C Reproduction	Navy	Electronic	Carrier-based early warning, strike control and surveillance aircraft
E-6A Air Comm (Hermes)	Navy	Electronic	Basic E-3 aircraft to replace EC-130Q for providing reliable and secure communications from National Command Authority to Fleet Ballistic Missile Submarines
EA-6B Upgrades (Prowler)	Navy	Electronic	Improved capability electronic countermeasures for EA-6B
EMSP (AN/ALR-2A (V))	Navy	Electronic	Enhanced Modular Signal Processor
F-14 Block Upgrade	Navy	Aircraft	Upgraded precision strike capability to F-14
F-14A/B/C (Tomcat)	Navy	Aircraft	Carrier based air defense fighter
F-14D (Tomcat)	Navy	Aircraft	Carrier based air defense fighter; has new engine, new digital avionics and upgraded radar
F/A-18 (Hornet)	Navy	Aircraft	Carrier based, multi-mission tactical aircraft
F/A-18E/F	Navy	Aircraft	Carrier-based, multirole fighter upgrade
FDS (Fixed Distribution System)	Navy	Electronic	Fixed Distribution System; passive acoustic surveillance system for detecting subs
FFG-7 (Class)	Navy	Ship	Oliver Perry class guided missile frigate
HFAJ System	Navy	Electronic	High Frequency Anti-Jam System; program to acquire HF/AJ communication system to meet Battle Group and tactical support needs
* JSOW (AIWS)	Navy	Missile	Joint Standoff Weapon Program (air to ground weapon system); formerly known as Advanced Interdiction Weapon System
JTIDS DTDMA	Navy	Electronic	Joint Tactical Information Distribution System/Distributed Time Division Multiple Access
LCAC-1	Navy	Ship	Landing Craft Air Cushion; provides ship-to-shore transportation of men and equipment
LHA (Assault Ship)	Navy	Ship	Tarawa class amphibious assault ship (deploys Marines by both helicopter and landing craft
LHD-1 (Class)	Navy	Ship	Wasp class amphibious assault ship (designed to land Marine forces)
Light Armored Vehicle	Navy	Vehicle	Marine version of Army LAV
* LPD 17 Class	Navy	Ship	LPD 17 Class Amphibious Transport Dock Ship
LSD-41 (Basic)	Navy	Ship	Whidbey Island class landing ship dock; provides transportation and launching of amphibious craft with their crews and embarking personnel
LSD-41 (Cargo Variant)	Navy	Ship	Variant of LSD-41 modified with smaller docking well (to accomodate more troops and equipment) and heavier-duty cranes
MCM-1	Navy	Ship	Avenger class Mine Countermeasures Ship
MHC-51	Navy	Ship	Coastal minehunter
* MIDS	Navy	Electronic	Multifunctional Information Distribution System (terminals)
MK-15 (Phalanx CIWS)	Navy	Munition	Close In Weapon System; automatically controlled gun system designed to provide defense against close in sea skimming
MK-48 (ADCAP)	Navy	Missile	ADditional CAPability; submarine-launched, conventional, wire-guided, acoustic homing torpedo (mod to basic MK-48)
MK-48 (TORPEDO)	Navy	Missile	Submarine launched, long-range, high speed acoustic homing torpedo

Table C.1 Weapon System Classification

MK-50 (TORPEDO)	Navy	Missile	Advanced LightWeight Torpedo; ship or aircraft launched anti submarine weapon system
MK-60 (Captor)	Navy	Munition	enCAPsulated TORpedo; mine consisting of encapsulated MK-46 torpedo
* MLR	Navy	Aircraft	Medium Lift Replacement is one alternative aircraft being considered to replace the CH-46E and CH-53A/D, the other alternative is the V-22.
NATO AAWS	Navy	Other	Anti Air Warfare System; NATO collaborative development encompassing detection thru engagement capability, optimized to meet the anti-ship cruise missile threat; provides for integration and control of dissimilar sensors, signature expansion, and integration of hardkill and softkill engagement resources
NATO PHM (Hydrofoil)	Navy	Ship	Pegasus class patrol combatant-missile (hydrofoil)
NESP	Navy	Electronic	EHF Satellite Communications Program (communications terminal)
NSSN	Navy	Ship	New Attack Submarine
P-3C (Orion)	Navy	Electronic	Land based anti-submarine patrol aircraft
P-3C Mod (Orion)	Navy	Electronic	Avionics updates of P-3C
P-7A (LRAACA)	Navy	Aircraft	Long Range Air ASW Capability Aircraft
RIM-66M,67D (MR/ER)	Navy	Missile	Ship launched surface-to-air missile; MR = Medium Range and ER = Extended Range
S-3A (Viking)	Navy	Aircraft	Carrier based anti-submarine patrol aircraft
SH-60R	Navy	Electronic	Upgrade program for LAMPS MK III (various electronic components)
* SEALIFT	Navy	Ship	Strategic sealift
SH-60F (CV Helo)	Navy	Electronic	Provides carrier inner zone ASW protection using an improved tethered sonar; replaces SH-3H
SSN-21	Navy	Ship	Seawolf class of nuclear powered attack submarine
SSN-688	Navy	Ship	Los Angeles class of nuclear powered attack submarine
SURTASS	Navy	Electronic	SURveillance Towed Array Sensor System
T-45/TS	Navy	Aircraft	Training System using T-45A Goshawk (modified version of British Aerospace Hawk)
T-AGOS	Navy	Ship	Surviellience ship
TAO-187 (Fleet Oiler)	Navy	Ship	TAO-187 class fleet oiler
Trident I (SUB)	Navy	Ship	Ohio class Trident I strategic missile submarines (SSBN-726 thru 733)
Trident II (SUB)	Navy	Ship	Ohio class Trident II strategic missile submarines (starting with SSBN-734)
UAV	Navy	Other	Unmanned air vehicles, various types and ranges
UGM-133A (Trident II)	Navy	Missile	Submarine launched ballistic missile
UGM-96A (Trident I)	Navy	Missile	Submarine launched ballistic missile
UHF Follow-on	Navy	Space	UHF Follow-On Communication Satellite System
V-22 (Osprey)	Navy	Helo	Multimission vertical takeoff and landing aircraft for airborne assault, search, and rescue
VAST	Navy	Electronic	Versatile Avionics Shop Test equipment
JTUAV	DoD	Other	UAV -- Maneuver part of JTUAV program
JTUAV (Hunter)	DoD	Other	UAV -- Hunter/Shipboard part of JTUAV program
Patriot PAC-3	DoD	Missile	Advanced capability air defense missile system
SDS/GPALS	DoD	Other	Mix of electronic and missile defense systems

INACTIVE PROGRAMS NOT COLLECTED DUE TO ABSENCE OF BASE YEAR DATA

C-5A (Galaxy)	Air Force	Aircraft	Transport aircraft
DSCS II	Air Force	Space	Defense Satellite Communication System (secure voice and high rate data transmission)
FB-111A (Bomber)	Air Force	Aircraft	Medium range strategic bomber
LGM-30F (Minuteman II)	Air Force	Missile	Three stage, solid propellant ICBM
AH-56 (Cheyenne)	Army	Helo	Attack helicopter
MBT-XM803	Army	Vehicle	Main Battle Tank (formerly MBT-70)
MGM-51 (Shillelagh)	Army	Missile	Tank-fired, IR-guided, optically-tracked anti-tank missile
AN/BQQ-5	Navy	Electronic	Sonar for nuclear attack submarines
AN/BQS-13 DNA	Navy	Electronic	Submarine search sonar, active/passive
AN/SQQ-23	Navy	Electronic	Sonar for patrol ships
AV-8A (Harrier)	Navy	Aircraft	V/STOL, light attack, close air support aircraft
DE 1052 (Escort)	Navy	Ship	Knox class escort (now reclassified as frigates)
DLG AAW Mod	Navy	Electronic	Guided Missile Frigate Anti-Air Warfare Modernization (to improve effectiveness of electronics and missile system)
SSN-637 (Sturgeon)	Navy	Ship	Sturgeon class nuclear attack submarine
SSN-685	Navy	Ship	Lipscomb class nuclear attack submarine
UGM-73A (Poseidon C-3)	Navy	Missile	Submarine launched ballistic missile

Appendix D
PROTOTYPE DESIGNATION

Classification of a program as to whether it was prototyped is an inherently difficult task. The information required to make that assessment is often not available, and what information is available is often ambiguous. We have adopted a broad definition of prototyping, developed as part of other RAND research. The following is the basic definition used here:

> A prototype is a distinct product (hardware or software) that allows hands-on testing in a realistic environment. In scope and scale, it represents a concept, subsystem, or production article with potential utility. It is built to improve the quality of decisions, not merely to demonstrate satisfaction of contract specifications. It is fabricated in the expectation of change, and is oriented towards providing information affecting risk management decisions.[15]

Based on the amount, relevance, and quality of information available, we have also rated our confidence in our prototyping designation: High confidence implies that the information we had available was enough for us to unambiguously apply our definition. The source of information is indicated, as well.

A related notion is that of precedent: Was there previous experience with this system type and/or technology, and if so, what type of experience? Generally, the same information required for making the prototyping designation will support a determination of precedent. There can be no precedent (e.g., F-15A), direct prototype (YF-16 to F-16), indirect prototype (XV-15 to V-22), or previous models (B-1A to B-1B). Only the second and third categories are prototypes: The first is a conventional development/production program, and the fourth is a modification program.

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[15] Drezner, 1992, p. 9.

Table D.1 Prototyping Designation

Program	Service	Weapon Type	Prototype?	Comments	Confid.	Precedent	Source	Phase
A-10 (Thunderbolt)	Air Force	Aircraft	yes	Competitive prototype phase, pre-FSD.	high	direct	R-2345	Dem/Val
A-7D (Corsair II)	Air Force	Aircraft	no	Concurrent development/production	med	previous	R-1452	
AAQ-11/12 (LANTIRN)	Air Force	Electronic	no	Pods built to test contract specs.	high	none	R-3937	
AGM-131A (SRAM II)	Air Force	Missile	yes	Subsystem, pre-FSD	med	previous	survey	Dem/Val
AGM-131A (SRAM-T)	Air Force	Missile	unknown					
AGM-134 (SICBM)	Air Force	Missile	yes	Boeing fabricated launch vehicle (truck)	med	indirect	R-4161	Dem/Val
AGM-136A (Tacit Rainbow)	Air Force	Missile	no		high	none	SAR	
AGM-65A (Maverick TV)	Air Force	Missile	unknown					
AGM-65C (Maverick Laser)	Air Force	Missile	unknown					
AGM-65D (Maverick)	Air Force	Missile	no	FSD test articles	high	previous	survey	
AGM-69A (SRAM)	Air Force	Missile	no		low	none		
AGM-86B (ALCM)	Air Force	Missile	yes	Subsystem prototyping; 1st flt pre-MSII	med	indirect	Brf Chart	Dem/Val
AGM-88A (HARM)	Air Force	Missile	yes	Prototype EXCAP version in adv devel	high	direct	SAR	EMD
AIM-120A (AMRAAM)	Air Force	Missile	yes	Competitive prototype phase, pre-FSD.	high	direct	R-3937	Dem/Val
AIM-129A (ACM)	Air Force	Missile	no		med	none		
AIM-7M (Sparrow)	Air Force	Missile	yes	Prototype seeker firings	high	direct	SAR	EMD
AIM-9L (Sidewinder)	Air Force	Missile	yes	prototype IOT&E models (28 msls)	high	direct	SAR	EMD
AIM-9M (Sidewinder)	Air Force	Missile	yes	pre-IOT&E testing and design change	low	direct	SAR	EMD
AN/FPS-118 (OTH-B)	Air Force	Electronic	no	Only 4 operational units.	high	none		
ASM-135A (ASAT)	Air Force	Missile	yes	Proto decision after MS II/FSD c/a	med	direct	SAR	EMD
ATARS	Air Force	Electronic	unknown					
B-1A (Bomber)	Air Force	Aircraft	no		high	none		
B-1B (Lancer)	Air Force	Aircraft	no	'A' version not prototype for 'B' version	high	previous		
B-52 (OAS/CMI, Stratofort.)	Air Force	Electronic	unknown					
BGM-109G (GLCM, Gryphon)	Air Force	Missile	yes	Subsystems; 1st flt pre-MSII	med	indirect	Brf Chart	Dem/Val
C-130H	Air Force	Aircraft	no		high	previous	SAR	none
C-17	Air Force	Aircraft	no	YC-14/15 too old.	high	none		
C-5B (Galaxy)	Air Force	Aircraft	no		high	previous		
CBU-97B (Sens Fuzed Weap)	Air Force	Munition	yes	A formal Risk Reduction test phase	med	direct	SAR	Dem/Val
CELV (Titan IV)	Air Force	Space	no		med	previous	SAR	
CIS (MARK XV IFF)	Air Force	Electronic	yes	Advanced devel. units in dem/val	high	direct	survey	Dem/Val
CMU	Air Force	Electronic	unknown			previous		
CSRL	Air Force	Other	unknown					
DSCS III	Air Force	Space	no	Space systems don't normally have prototypes	med	previous		
DSP	Air Force	Space	no	Space systems don't normally have prototypes	med	none		
E-3A (AWACS, Sentry)	Air Force	Electronic	yes	Brassboard flt	med	direct	R-4161	Dem/Val
E-3A (RSIP)	Air Force	Electronic	yes		high	direct		EMD
E-4 (AABNCP NEACP)	Air Force	Electronic	no	All ac intended to be operational	med	none	SAR	
EF-111A (Raven)	Air Force	Electronic	unknown					
F-111 A/D/E/F	Air Force	Aircraft	no		high	none		
F-15 (Eagle)	Air Force	Aircraft	no		high	none		
F-16 (Falcon)	Air Force	Aircraft	yes	Competitive proto phase, pre-FSD.	high	direct	R-2345	Dem/Val
F-22 (ATF, Adv. Tactical Fighter)	Air Force	Aircraft	yes	Competitive prototype phase, pre-FSD.	high	direct	SAR	Dem/Val
F-5E (Tiger II)	Air Force	Aircraft	yes		med	previous	IDA P-2201	EMD
FEWS	Air Force	Space	yes		high	direct	SAR	Dem/Val
HH-60D (Night Hawk)	Air Force	Helo	yes	Designated aircraft T-1 as prototype w/flt test	med	direct	SAH	EMD
I-SA (AMPE)	Air Force	Electronic	no	Terminated before any units delivered	high	none	SAR	
IUS	Air Force	Space	no	FSD models were operational	high	none	SAR	
JDAM	Air Force	Munition	yes		high	direct	SAR	Dem/Val
JPATS	Air Force	Aircraft	yes		med	direct	SAR	EMD
JSIPS	Air Force	Electronic	yes		med	direct	SAR	Dem/Val
JSTARS	Air Force	Electronic	no		med	none	survey	
JTIDS	Air Force	Electronic	no	Articles built to test contract specs.	med	none	R-3937	
JTIDS (Enhanced EJS)	Air Force	Electronic	unknown					
KC-10A (Extender)	Air Force	Aircraft	yes	Demo feasibility of commercial conversion	med	direct	SAR	EMD
KC-135R (Stratotanker)	Air Force	Aircraft	no	Design and production C/A at same time	high	previous	SAR	
KG-44 (DMSP)	Air Force	Space	no	Space systems don't normally have prototypes	med	none		
Laser Bomb Guidance	Air Force	Electronic	unknown					
LGM-118A (Peacekeeper)	Air Force	Missile	no		med	none		
LGM-30G (Minuteman III)	Air Force	Missile	unknown					
MILSTAR	Air Force	Space	yes		med	direct	SAR	EMD
MLS	Air Force	Electronic	no	Commercial development; NDI	med	previous		
MLV III	Air Force	Space	no		high	none	SAR	none

Table D.1 Prototyping Designation

Program	Service	Weapon Type	Prototype?	Comments	Confid.	Precedent	Source	Phase
MMIII GRP	Air Force	Electronic	no		high	none	SAR	none
NAS	Air Force	Electronic	yes	MAMS prototype demonstration program	med	none	SAR	Dem/Val
Navstar GPS (Sat.)	Air Force	Space	yes	Both satellite and UE was prototyped, pre-FSD.	high	direct	R-3937	Dem/Val
Navstar GPS (U.E.)	Air Force	Electronic	no					
PLSS	Air Force	Electronic	no	only 1 RDT&E unit delivered before termination	high	none		
Rail Garrison	Air Force	Other	no		med	none		
T-46A (Next Gener. Train.)	Air Force	Aircraft	no	FSD unit was built to test contract specs.	high	none	SAR	
UTTMDS	Air Force	Missile	yes		low	unk	SAR	Dem/Val
UXC-4 (TRI-TAC)	Air Force	Electronic	no		low	none	SAR	
WWMCCS (WIS)	Air Force	Electronic	unknown					
AAWS-M (Javelin)	Army	Missile	yes		high	indirect		Dem/Val
ADDS	Army	Electronic	unknown					
AFAS/FARV	Army	Munition	yes	Prototype in schedule	high	none	SAR	EMD
AFATDS	Army	Electronic	yes		high	indirect		Dem/Val
AGM-114A (Hellfire)	Army	Missile	yes	Seeker units and full systems built	high	direct	survey	Dem/Val
AGM-136A (JGLTacitRnbw)	Army	Missile	no		med	previous		
AH-64 (Apache)	Army	Helo	yes	Competitive phase, pre-FSD.	high	direct	R-2345	Dem/Val
AH-66 (Comanche)	Army	Helo	yes	Subsystems (MEP)	med	direct		Dem/Val
AN/GSG-10 (TACFIRE)	Army	Electronic	unknown					
AN/TTC-39	Army	Electronic	no	See TRI-TAC	low	none	SAR	
AN/USQ-84 (SOTAS)	Army	Electronic	yes	Early feasibility testing	med	direct	SAR	Dem/Val
ARVS (Scout)	Army	Vehicle	unknown					
ASAS/ENSCE	Army	Electronic	unknown					
ASM	Army	Vehicle	yes		high	direct		Dem/Val
ATCCS/CHS	Army	Electronic	yes	Prototype testing listed in schedule milestones	med	direct	SAR	?
BAT	Army	Munition	yes	Proto phase shown in schedule	high	indirect	SAR	EMD
BFVS A3	Army	Vehicle	no	Modification program	high	previous	SAR	
BGM-71A (TOW)	Army	Missile	yes		low	direct	SAR	EMD
BGM-71C/D (TOW II)	Army	Missile	yes	Subsystems, testing during FSD upgrade	med	previous	survey	EMD
CH-47D (Chinook)	Army	Helo	yes	Subsystem upgrade/integration tested	high	direct	survey	EMD
CSSCS	Army	Electronic	yes	Proto version 4 in schedule	med	none	SAR	Dem/Val
FAAD C2I	Army	Electronic	no	NDI	high	none	survey	
FAADS LOS-F-H (ADATS)	Army	Missile	yes	Competitive prototype, company financed.	med	direct	survey	Dem/V ll
FAADS LOS-R (Avenger)	Army	Missile	no	Direct to LRIP c/a: non-developmental item	med	previous		
FAADS NLOS (FOG-M)	Army	Missile	yes	FOG-M as indirect proto	high	indirect	survey	Dem/Val
FGM-77A (Dragon)	Army	Missile	unknown					
FHTV (PLS)	Army	Vehicle	yes	Prototyping c/a after ASARC I/II	med	direct	SAR	EMD
FIM-92A/B (Stinger/Stinger-Post)	Army	Missile	unknown					
FIM-92C (Stinger-RMP)	Army	Missile	no		low	previous		
FMTV	Army	Vehicle	yes	Prototyping phase in schedule after FSD start	med	direct	SAR	EMD
HLH	Army	Helo	unknown					
JSTARS -GSM	Army	Electronic	yes	Pre-MS 2 flt test & Gulf war deployment	med	none	SAR	EMD
JTIDS	Army	Electronic	no	Articles built to test contract specs	med	none	R-3937	
JTMD/ATM	Army	Missile	unknown					
LAV	Army	Vehicle	unknown					
Longbow Apache-AFM	Army	Helo	no		high	previous	SAR	none
LongbwApache	Army	Electronic	yes		high	direct		Dem/Val
Longbwhllfire	Army	Missile	yes		med	previous		Dem/Val
M-1 (Abrams)	Army	Vehicle	yes	Competitive phase, pre-FSD	high	direct	R-3937	Dem/Val
M-109 (Howitzer 155)	Army	Munition	unknown					
M-198 (Med. Tow Howitzer)	Army	Munition	yes	Advanced development phase: 1 prototype	high	direct		Dem/Val
M-2/3 (Bradley FVS)	Army	Vehicle	yes	MICV in FSED & proto qual test	med	direct	R-4161	EMD
M-26 (MLRS)	Army	Munition	yes	Competitive phase	high	direct	R-3937	Dem/Val
M-60A2 Tank	Army	Vehicle	unknown					
M-712 (Copperhead)	Army	Munition	yes	Both ammo and production facility tested.	high	direct	survey	Dem/Val
M-988 (DIVAD Sgt York)	Army	Munition	yes	Competitive phase, pre-FSD	high	direct	R-3937	Dem/Val
MCS	Army	Electronic	yes	CHS proto	high	none	SAR	Dem/Val
MGM-131B (Pershing II)	Army	Missile	yes	preproduction, partial system	med	previous	survey	EMD
MGM-140A (ATACMS)	Army	Missile	no		low	none	SAR	
MGM-140A (ATACMS/BAT)	Army	Missile	unknown	see ATACMS and BAT programs				
MGM-50 (Lance)	Army	Missile	unknown					
MIM-104 (Patriot)	Army	Missile	unknown					
MIM-115 (Roland)	Army	Missile	no	(for US) Already in production	med	previous	SAR	

Table D.1 Prototyping Designation

Program	Service	Weapon Type	Prototype?	Comments	Confid.	Precedent	Source	Phase
MIM-23B (Improved Hawk)	Army	Missile	unknown					
MLRS/TGW	Army	Munition	yes	Competitive demonstration	low	direct		Dem/Val
MSE	Army	Electronic	yes	Competitive off the shelf systems	high	direct	survey	EMD
OH-58D (AHIP)	Army	Electronic	yes	5 units built to test design configuration, utility.	high	direct	SAR/srvy.	EMD
Patriot P3I	Army	Electronic	no		high	previous	SAR	none
RPV	Army	Other	unknown					
SADARM	Army	Munition	yes	Competitive demonstation/validation phase	med	direct	SAR	Dem/Val
Safeguard	Army	Missile	unknown					
SCAMP	Army	Space	no		high	unk	SAR	none
SINCGARS-V	Army	Electronic	yes	LRIP "dry run": not deployable	high	direct	survey	EMD
SMART-T	Army	Electronic	no		high	none	SAR	none
Stingray	Army	Electronic	yes	Deployed in Gulf war pre-MS 2	high	none	SAR	Dem/Val
UH-60 (Blackhawk)	Army	Helo	yes	Competitive post-MS II; RAM-D emphasis.	high	direct	R-2345	EMD
UH-60L	Army	Helo	no	"A" version was prototyped	high	previous	SAR	
5" Guided Projectile	Navy	Munition	yes	Advanced development units	high	direct	SAR	Dem/Val
8" Guided Projectile	Navy	Munition	unknown					
A-6E/F (Intruder)	Navy	Aircraft	no			previous		
A-7E (Corsair II)	Navy	Aircraft	no	1st flt and 1st acceptance in same month	high	previous		
AAAM	Navy	Missile	yes	OT&E during dem/val	med	direct	SAR	Dem/Val
AAAV	Navy	Vehicle	yes	Listed in schedule	high	indirect	SAR	Dem/Val
Aegis Mk 7	Navy	Electronic	unknown					
AFX	Navy	Aircraft	yes	Planned competitive prototype phase	low	direct	SAR	Dem/Val
AGM-53A (Condor)	Navy	Missile	yes	Prototype RDT&E c/a	med	direct	SAR	Dem/Val
AGM-88A (HARM)	Navy	Missile	yes	Prototyped EXCAP version	high	direct	SAR	EMD
AGM/RGM/UGM-84A (HARPOON)	Navy	Missile	yes	1st proto flt after FSD c/a	low	direct	IDA P-2201	EMD
AIM-120A (AMRAAM)	Navy	Missile	yes	Competitive phase, pre-FSD.	high	direct	R-3937	Dem/Val
AIM-54A (Phoenix)	Navy	Missile	yes	Prototype missile testing in schedule	med	direct	SAR	EMD
AIM-54C (Phoenix)	Navy	Missile	no	FSD test articles focused on specs	med	previous	SAR	
AIM-7M (Sparrow)	Navy	Missile	yes	Prototype seeker firings	high	previous	SAR	EMD
AIM-9L (Sidewinder)	Navy	Missile	yes	prototype IOT&E models (28 msls)	high	previous	SAR	EMD
AIM-9M (Sidewinder)	Navy	Missile	yes	pre-IOT&E testing and design change	low	previous	SAR	EMD
AIM-9X	Navy	Missile	unknown			previous	SAR	
AN/ALQ-165 (ASPJ)	Navy	Electronic	yes	FSD prototype units	low	direct	SAR	EMD
AN/APS-124 (LAMPS MKIII)	Navy	Electronic	yes	Subsystems; FSD c/a was for proto	low	indirect	IDA P-2201	EMD
AN/BSY-1/2 (SUBACS comb)	Navy	Electronic	no		low	none	survey	
AN/SQQ-89 (ASWCS)	Navy	Electronic	unknown					
AN/SQR-19 (TACTAS)	Navy	Electronic	yes	Prototype delivery/test after FSD	high	direct	SAR/srvy.	EMD
AN/SQY-1	Navy	Electronic	no		med	none		
AN/TPS-71 (ROTHR)	Navy	Electronic	yes		med	direct		EMD
AOE-6	Navy	Ship	no	Leadship not considered a prototype.	high	none		
AQM-127A (SLAT)	Navy	Other	no	Spec testing planned	med	none	SAR	
ASWSOW (Sea Lance)	Navy	Missile	yes	Subsystem "bread board" during dem/val	med	direct	survey	Dem/Val
AV-8B (Harrier II)	Navy	Aircraft	yes		high	direct	survey	EMD
AV-8B Remanufacture	Navy	Aircraft	no		high	previous	SAR	
Battleship React.	Navy	Ship	no	not applicable	high	previous		
BGM-109 (Tomahawk)	Navy	Missile	yes	Subsystems (see also ALCM, GLCM)	high	indirect	Brf Chart	Dem/Val
CMH-53 (Super Stallion)	Navy	Helo	yes	YCH-53 @ dem/val & "E" version FSD proto	high	direct		Dem/Val
CG-47 (Aegis Cruiser,	Navy	Ship	no	Leadship not considered a prototype.	high	none		
CGN-38	Navy	Ship	no	Leadship not considered a prototype.	high	none		
CVN 68, 69, 70	Navy	Ship	no	Leadship not considered a prototype.	high	none		
CVN 71	Navy	Ship	no	Leadship not considered a prototype.	high	previous		
CVN 72, 73	Navy	Ship	no	Leadship not considered a prototype.	high	previous		
CVN 74, 75	Navy	Ship	no	Leadship not considered a prototype.	high	previous		
CVN 77	Navy	Ship	no		high	previous	SAR	none
CVN-76	Navy	Ship	no		high	none		
DD-963 (Destroyer)	Navy	Ship	no	Leadship not considered a prototype.	high	none		
DDG-51	Navy	Ship	no	Leadship not considered a prototype.	high	none		
E-2C (Hawkeye)	Navy	Electronic	no	R&D and prod. contracts too close	high	previous	SAR	
E-2C Reproduction	Navy	Electronic	no			previous	SAR	
E-6 Air Comm (Hermes)	Navy	Electronic	yes	Proto delivery after DSARC III	low	direct	R-4161	EMD
EA-6B Upgrade (Prowler)	Navy	Electronic	unknown					
EMSP (AN/UYS - 2A (v))	Navy	Electronic	yes	Subsys (VHSIC) proto in dem/val	low	direct	SAR	Dem/Val
F-14 Block 1 Strike	Navy	Aircraft	no	Modification program	high	previous	SAR	

Table D.1 Prototyping Designation

Program	Service	Weapon Type	Prototype?	Comments	Confid.	Precedent	Source	Phase
F-14A (Tomcat)	Navy	Aircraft	no		high	none	R-4161	
F-14D (Tomcat)	Navy	Aircraft	no		high	previous	R-4161	
F/A-18 (Hornet)	Navy	Aircraft	yes	YF-17 was basic design/technology demo.	high	indirect	R-3937	Dem/Val
F/A-18E/F	Navy	Aircraft	no	Not in current acq plan	high	previous	SAR	
FDS (Fixed Distribution System)	Navy	Electronic	yes	Full system test pre-FSD	med	direct	SAR	Dem/Val
FFG-7	Navy	Ship	no	Leadship not considered a prototype.	high	none		
HFAJ System	Navy	Electronic	unknown					
JSCW (AIWS)	Navy	Missile	yes		low	direct	SAR	Dem/Val
JTIDS DTDMA	Navy	Electronic	unknown					
LCAC-1	Navy	Ship	yes	Prototype c/a in 1970	high	direct	SAR	Dem/Val
LHA (Assault Ship)	Navy	Ship	no	Leadship not considered a prototype.	high	none		
LHD-1	Navy	Ship	no	Leadship not considered a prototype.	high	none		
Light Armored Vehicle	Navy	Vehicle	unknown					
LPD 17 Class	Navy	Ship	unknown		unk	unk	SAR	
LSD-41 (Basic)	Navy	Ship	no	Leadship not considered a prototype.	high	none		
LSD-41 (Cargo Variant)	Navy	Ship	no	Leadship not considered a prototype.	high	previous		
MCM-1	Navy	Ship	no	Leadship not considered a prototype.	high	none		
MHC-51	Navy	Ship	no	no proto by definition	high	direct	SAR	
MIDS	Navy	Electronic	yes		med	direct	SAR	EMD
MK-15 (Phalanx CIWS)	Navy	Munition	yes	Prototype testing at sea after ED c/a	high	direct	SAR	EMD
MK-48 (ADCAP)	Navy	Missile	unknown					
MK-48 (TORPEDO)	Navy	Missile	yes	Development and prod protos fabricated	high	direct	SAR	EMD
MK-50 (TORPEDO)	Navy	Missile	yes	Competitive dem/val w/hardware test (DT/OT I)	high	direct	SAR	Dem/Val
MK-60 (Captor)	Navy	Munition	unknown					
MLR	Navy	Aircraft	unknown		unk	unk	SAR	
NATO AAWS	Navy	Other	unknown					
NATO PHM (Hydrofoil)	Navy	Ship	no	Leadship not considered a prototype.	high	none		
NESP	Navy	Electronic	unknown			unk		
NSSN	Navy	Ship	no		high	none	SAR	
P-3C (Orion)	Navy	Electronic	no	R&D and production c/a too close	low	previous	SAR	
P-3C Mod (Orion)	Navy	Electronic	no		low	previous	SAR	
P-7A (LRAACA)	Navy	Aircraft	no	Immediate entry into FFP FSD contract	high	none	SAR	
RIM-66M,67D (MR/ER)	Navy	Missile	no		low	previous	SAR	
S-3A (Viking)	Navy	Aircraft	no	1st fit after prod. c/a	high	none	SAR	
SEALIFT	Navy	Ship	unknown		unk	unk	SAR	
SH-60F (CVHELO)	Navy	Electronic	no	Spec testing only	med	previous	SAR	
SH-60R	Navy	Electronic	unknown			unk		
SSN-21	Navy	Ship	no	Leadship not considered a prototype.	high	none		
SSN-688	Navy	Ship	no	Leadship not considered a prototype.	high	none		
SURTASS	Navy	Electronic	no	Tests focused on specs	med	none	SAR	
T-45/TS	Navy	Aircraft	no	FSD units built to test contract specs	high	previous	SAR	
T-AGOS	Navy	Ship	no	no proto by definition	high	direct	SAR	
TAO-187 (Fleet Oiler)	Navy	Ship	no	Leadship not considered a prototype.	high	none		
Trident I (SUB)	Navy	Ship	no	Leadship not considered a prototype.	high	none		
Trident II (SUB)	Navy	Ship	no	Leadship not considered a prototype.	high	none		
UAV	Navy	Other	unknown		unk	direct	SAR	
UGM-133A (Trident II)	Navy	Missile	no		med	none	survey	
UGM-96A (Trident I)	Navy	Missile	no		med	none		
UHF Follow-on	Navy	Space	no	Space systems not usually prototyped	high	none		
V-22 (Osprey)	Navy	Helo	yes	XV-15 is technology demo	high	indirect	survey	Dem/Val
VAST	Navy	Electronic	unknown					
JTUAV	DoD	Other	yes	Technology demo program	med	no	SAR	Dem/Val
JTUAV (Hunter)	DoD	Other	unknown			previous	SAR	
Patriot PAC-3	DoD	Missile	yes	ERINT and FLAGE technology demos	med	indirect	SAR	Dem/Val
SDS/GPALS	OSD	Other	unknown					

Appendix E

MODIFICATION DESIGNATION

Table E.1 indicates whether the program is a modification of an existing program or a new program start. The determination was made in part based on information used to make the prior experience assessment in Table D.1. Modifications include major subsystem upgrades, replacements, add-ons, life-extension programs, etc. Modification programs can often be identified by mission and/or capability changes to existing systems and are sometimes associated with a change in designation (e.g., "A" version to "C" version). Nondevelopment item (NDI) programs are considered modifications.

Table E.1 Modification Designation

Program	Service	Weapon Type	Modification?	Comments, etc
A-10 (Thunderbolt)	Air Force	Aircraft	no	Built from scratch
A-7D (Corsair II)	Air Force	Aircraft	yes	Earlier A-7's (Navy versions)
AAQ-11/12 (LANTIRN)	Air Force	Electronic	no	No precedent
AGM-131A (SRAM II)	Air Force	Missile	yes	Original SRAM program
AGM-131A (SRAM-T)	Air Force	Missile	yes	Original SRAM program
AGM-134 (SICBM)	Air Force	Missile	no	No precedent
AGM-136A (Tacit Rainbow)	Air Force	Missile	no	No precedent
AGM-65A (Maverick TV)	Air Force	Missile	no	Original version
AGM-65C (Maverick Laser)	Air Force	Missile	yes	Seeker mod
AGM-65D (Maverick)	Air Force	Missile	yes	Seeker mod
AGM-69A (SRAM)	Air Force	Missile	no	
AGM-86B (ALCM)	Air Force	Missile	no	No precedent
AGM-88A (HARM)	Air Force	Missile	no	
AIM-120A (AMRAAM)	Air Force	Missile	no	No precedent
AIM-129A (ACM)	Air Force	Missile	no	
AIM-7M (Sparrow)	Air Force	Missile	yes	Earlier Sparrows ("F", "L" versions)
AIM-9L (Sidewinder)	Air Force	Missile	yes	Earlier versions
AIM-9M (Sidewinder)	Air Force	Missile	yes	Earlier versions
AN/FPS-118 (OTH-B)	Air Force	Electronic	no	No precedent
ASM-135A (ASAT)	Air Force	Missile	no	No precedent
ATARS	Air Force	Electronic	no	No precedent
B-1A (Bomber)	Air Force	Aircraft	no	New development
B-1B (Lancer)	Air Force	Aircraft	yes	Upgrade of B-1A
B-52 (OAS/CMI, Stratofort.)	Air Force	Electronic	yes	Avionics upgrade
BGM-109G (GLCM, Gryphon)	Air Force	Missile	yes	ACLM/SLCM derivative
C-130H	Air Force	Aircraft	yes	C-130E w/ advanced engines and propellers
C-17	Air Force	Aircraft	no	New development
C-5B (Galaxy)	Air Force	Aircraft	yes	Based on C-5A
CBU-97B (Sens Fuzed Weap)	Air Force	Munition	no	
CELV (Titan IV)	Air Force	Space	yes	Earlier Titan systems
CIS (MARK XV IFF)	Air Force	Electronic	no	New technology
CMU	Air Force	Electronic	yes	
CSRL	Air Force	Other	no	New use/new tech
DSCS III	Air Force	Space	no	Unique satelite systems
DSP	Air Force	Space	no	Unique satelite systems
E-3A (AWACS, Sentry)	Air Force	Electronic	no	New development
E-3A (RSIP)	Air Force	Electronick	yes	
E-4 (AABNCP NEACP)	Air Force	Electronic	no	New ac (Boeing 747) w/new electronics.
EF-111A (Raven)	Air Force	Electronic	yes	Mission/avionics change
F-111 A/D/E/F	Air Force	Aircraft	no	Original version was new
F-15 (Eagle)	Air Force	Aircraft	no	Original version was new
F-16 (Falcon)	Air Force	Aircraft	no	Original version was new
F-22 (ATF, Adv. Tactical Fighter)	Air Force	Aircraft	no	New technology
F-5E (Tiger II)	Air Force	Aircraft	yes	
FEWS	Air Force	Space	no	
HH-60D (Night Hawk)	Air Force	Helo	yes	UH-60 derivative
I-SA (AMPE)	Air Force	Electronic	no	
IUS	Air Force	Space	no	New booster development
JDAM	Air Force	Munition	no	
JPATS	Air Force	Aircraft	no	Replaces AF's T-37B, N's T-34C
JSIPS	Air Force	Electronic	no	
JSTARS	Air Force	Electronic	no	No precedent
JTIDS	Air Force	Electronic	no	No precedent
JTIDS (Enhanced EJS)	Air Force	Electronic	yes	Basic JTIDS TDMA
KC-10A (Extender)	Air Force	Aircraft	no	Does not count mod of DC-10 to military configuration.
KC-135R (Stratotanker)	Air Force	Aircraft	yes	New engine.
KG-44 (DMSP)	Air Force	Space	no	Unique satelite systems
Laser Bomb Guidance	Air Force	Electronic	yes	This is 3rd generation of kit.
LGM-118A (Peacekeeper)	Air Force	Missile	no	No precedent
LGM-30G (Minuteman III)	Air Force	Missile	yes	
MILSTAR	Air Force	Space	no	Takes over DSCS and SATCOM missions
MLS	Air Force	Electronic	yes	Part commercial, part new development
MLV III	Air Force	Space	no	

Table E.1 Modification Designation

Program	Service	Weapon Type	Modification?	Comments, etc
MMIII GRP	Air Force	Electronic	no	Replaces Minuteman guidance system electronics
NAS	Air Force	Electronic	yes	Modernization program includes direct upgrades to existing systems
Navstar GPS (Sat.)	Air Force	Space	no	No precedent
Navstar GPS (U.E.)	Air Force	Electronic	no	
PLSS	Air Force	Electronic	no	
Rail Garrison	Air Force	Other	no	No precedent
T-46A (Next Gener. Train.)	Air Force	Aircraft	no	
UTTMDS	Air Force	Missile	no	No precedent
UXC-4 (TRI-TAC)	Air Force	Electronic	no	
WWMCCS (WIS)	Air Force	Electronic	yes	Modernization program
AAWS-M (Javelin)	Army	Missile	no	
ADDS	Army	Electronic	no	
AFAS/FARV	Army	Munition	no	
AFATDS	Army	Electronic	no	
AGM-114A (Hellfire)	Army	Missile	no	
AGM-136A (JGLTactRnbw)	Army	Missile	yes	
AH-64 (Apache)	Army	Helo	no	
AH-66 (Comanche)	Army	Helo	no	
AN/GSG-10 (TACFIRE)	Army	Electronic	no	New development
AN/TTC-39	Army	Electronic	no	See TRI-TAC
AN/USQ-84 (SOTAS)	Army	Electronic	no	
ARVS (Scout)	Army	Vehicle	no	New development
ASAS/ENSCE	Army	Electronic	no	No precedent
ASM	Army	Vehicle	no	
ATCCS/CHS	Army	Electronic	no	No precedent
BAT	Army	Munition	no	New development
BFVS A3	Army	Vehicle	yes	Bradley FVS upgrade
BGM-71A (TOW)	Army	Missile	no	
BGM-71C/D (TOW II)	Army	Missile	yes	
CH-47D (Chinook)	Army	Helo	yes	
CSSCS	Army	Electronic	no	New development
FAAD C2I	Army	Electronic	no	
FAADS LOS-F-H (ADATS)	Army	Missile	no	
FAADS LOS-R (Avenger)	Army	Missile	yes	New application of basic Stinger missile.
FAADS NLOS (FOG-M)	Army	Missile	no	First application of FOG-M
FGM-77A (Dragon)	Army	Missile	no	New development
FHTV (PLS)	Army	Vehicle	no	New system design/configuration
FIM-92A/B (Stinger/Stinger-Post)	Army	Missile	no	
FIM-92C (Stinger-RMP)	Army	Missile	yes	
FMTV	Army	Vehicle	no	
HLH	Army	Helo	unk	
JSTARS - GSM	Army	Electronic	no	New development
JTIDS	Army	Electronic	no	
JTMD/ATM	Army	Missile	no	
LAV	Army	Vehicle	no	
Longbow Apache-AFM	Army	Helo	yes	Modified AH-64 airframe with FCR and 701-C engine
LongbwApache	Army	Electronic	yes	
LongbwHlfire	Army	Missile	yes	
M-1 (Abrams)	Army	Vehicle	no	
M-109 (Howitzer 155)	Army	Munition	no	New development
M-198 (Med. Tow Howitzer)	Army	Munition	no	Developed from scratch
M-2/3 (Bradley FVS)	Army	Vehicle	no	
M-26 (MLRS)	Army	Munition	no	
M-60A2 Tank	Army	Vehicle	yes	
M-712 (Copperhead)	Army	Munition	no	
M-988 (DIVAD Sgt York)	Army	Munition	no	
MCS	Army	Electronic	no	New development
MGM-131B (Pershing II)	Army	Missile	yes	
MGM-140A (ATACMS)	Army	Missile	no	No precedent
MGM-140A (ATACMS/BAT)	Army	Missile	no	
MGM-50 (Lance)	Army	Missile	no	
MIM-104 (Patriot)	Army	Missile	no	
MIM-115 (Roland)	Army	Missile	yes	System design was imported with some modification.

Table E.1 Modification Designation

Program	Service	Weapon Type	Modification?	Comments, etc
MIM-23B (Improved Hawk)	Army	Missile	yes	
MLRS/TGW	Army	Munition	no	
MSE	Army	Electronic	yes	NDI commercial development
OH-58D (AHIP)	Army	Electronic	yes	OH-58A/C
Patriot P3I	Army	Electronic	yes	Improvements include radar, comm, and computer capabilities
RPV	Army	Other	no	
SADARM	Army	Munition	no	
Safeguard	Army	Missile	no	
SCAMP	Army	Space	no	
SINCGARS-V	Army	Electronic	no	
SMART-T	Army	Electronic	no	Displaces AN/TSC85s and 93s (gmd mobile terminals)
Stingray	Army	Electronic	no	No precedent
UH-60 (Blackhawk)	Army	Helo	no	
UH-60L	Army	Helo	yes	Engine upgrade to UH-60A
5" Guided Projectile	Navy	Munition	yes	Similar to Copperhead
8" Guided Projectile	Navy	Munition	yes	Based on 5 in GP
A-6E/F (Intruder)	Navy	Aircraft	yes	Earlier version
A-7E (Corsair II)	Navy	Aircraft	yes	Earlier version
AAAM	Navy	Missile	no	New development
AAAV	Navy	Vehicle	no	
Aegis Mk 7	Navy	Electronic	no	
AFX	Navy	Aircraft	no	
AGM-53A (Condor)	Navy	Missile	no	
AGM-88A (HARM)	Navy	Missile	no	
AGM/RGM/UGM-84A (HARPOON)	Navy	Missile	no	
AIM-120A (AMRAAM)	Navy	Missile	no	
AIM-54A (Phoenix)	Navy	Missile	no	
AIM-54C (Phoenix)	Navy	Missile	yes	Earlier version
AIM-7M (Sparrow)	Navy	Missile	yes	Earlier version
AIM-9L (Sidewinder)	Navy	Missile	yes	Earlier version
AIM-9M (Sidewinder)	Navy	Missile	yes	
AIM-9X	Navy	Missile	yes	Evolutionary improvements to AIM-9 series of air-to-air missiles
AN/ALQ-165 (ASPJ)	Navy	Electronic	no	
AN/APS-124 (LAMPS MKIII)	Navy	Electronic	yes	UH-60 mod
AN/BSY-1/2 (SUBACS comb)	Navy	Electronic	no	Original program was new development
AN/SQQ-89 (ASWCS)	Navy	Electronic	yes	Integration of subsystems developed separately
AN/SQR-19 (TACTAS)	Navy	Electronic	no	AN/SQR-19
AN/SQY-1	Navy	Electronic	yes	
AN/TPS-71 (ROTHR)	Navy	Electronic	no	
AOE-6	Navy	Ship	no	
AQM-127A (SLAT)	Navy	Other	no	
ASWSOW (Sea Lance)	Navy	Missile	no	
AV-8B (Harrier II)	Navy	Aircraft	yes	Earlier version
AV-8B Remanufacture	Navy	Aircraft	yes	Conversion of older AV-8B models to most recent production configuration
Battleship React.	Navy	Ship	yes	
BGM-109 (Tomahawk)	Navy	Missile	yes	ALCM modification
C/MH-53 (Super Stallion)	Navy	Helo	no	
CG-47 (Aegis Cruiser)	Navy	Ship	no	New class
CGN-38	Navy	Ship	no	New class
CVN 68, 69, 70	Navy	Ship	no	New class
CVN 71	Navy	Ship	yes	Follow-on ships in class with changes in systems.
CVN 72, 73	Navy	Ship	yes	Follow-on ships in class with changes in systems.
CVN 74, 75	Navy	Ship	yes	Follow-on ships in class with changes in systems.
CVN 77	Navy	Ship	yes	
CVN-76	Navy	Ship	yes	
DD-963 (Destroyer)	Navy	Ship	no	New class
DDG-51	Navy	Ship	no	New class
E-2C (Hawkeye)	Navy	Electronic	yes	
E-2C Reproduction	Navy	Electronic	yes	Electronic system upgrades in new production aircraft
E-6 Air Comm (Hermes)	Navy	Electronic	no	
EA-6B Upgrade (Prowler)	Navy	Electronic	yes	
EMSP (AN/UYS-2A(v))	Navy	Electronic	no	New development
F-14 Block 1 Strike	Navy	Aircraft	yes	Upgraded precision strike capabilities

Table E.1 Modification Designation

Program	Service	Weapon Type	Modification?	Comments, etc
F-14A (Tomcat)	Navy	Aircraft	no	
F-14D (Tomcat)	Navy	Aircraft	yes	
F/A-18 (Hornet)	Navy	Aircraft	no	
F/A-18E/F	Navy	Aircraft	yes	Upgrade to C/D version
FDS (Fixed Distribution System)	Navy	Electronic	yes	Commercial system conversion
FFG-7	Navy	Ship	no	New class
HFAJ System	Navy	Electronic	no	
JSOW (AIWS)	Navy	Missile	no	
JTIDS DTDMA	Navy	Electronic	no	Technology differs from basic JTIDS.
LCAC-1	Navy	Ship	no	
LHA (Assault Ship)	Navy	Ship	no	New class
LHD-1	Navy	Ship	no	New class
Light Armored Vehicle	Navy	Vehicle	no	
LPD 17 Class	Navy	Ship	no	Replaces the LPD 4, LSD 36, LKA 113, and LST 1179 ships
LSD-41 (Basic)	Navy	Ship	no	New class
LSD-41 (Cargo Variant)	Navy	Ship	yes	
MCM-1	Navy	Ship	no	New class
MHC-51	Navy	Ship	no	New development
MIDS	Navy	Electronic	no	No precedent
MK-15 (Phalanx CIWS)	Navy	Munition	no	New concept (gun slaved to radar)
MK-48 (ADCAP)	Navy	Missile	yes	
MK-48 (TORPEDO)	Navy	Missile	no	
MK-50 (TORPEDO)	Navy	Missile	no	
MK-60 (Captor)	Navy	Munition	no	EnCAPsulated Mk-46 TORpedo: new concept
MLR	Navy	Aircraft	no	Possible replacement for CH-47E and CH-53A/D
NATO AAWS	Navy	Other	no	New development
NATO PHM (Hydrofoil)	Navy	Ship	no	
NESP	Navy	Electronic	no	
NSSN	Navy	Ship	no	
P-3C (Orion)	Navy	Electronic	yes	
P-3C Mod (Orion)	Navy	Electronic	yes	
P-7A (LRAACA)	Navy	Aircraft	no	
RIM-66M,67D (MR/ER)	Navy	Missile	yes	RIM-67C based on Std Msl 1
S-3A (Viking)	Navy	Aircraft	no	New development
SEALIFT	Navy	Ship	no	
SH-60F (CVHELO)	Navy	Electronic	yes	Added combat system to SH-60B.
SH-60R	Navy	Electronic	yes	Upgrade to LAMPS Mk III (various electronic components)
SSN-21	Navy	Ship	no	
SSN-688	Navy	Ship	no	
SURTASS	Navy	Electronic	no	Mobile SOSUS
T-45/TS	Navy	Aircraft	yes	Modified BAe Hawk.
T-AGOS	Navy	Ship	no	New development
TAO-187 (Fleet Oiler)	Navy	Ship	no	
Trident I (SUB)	Navy	Ship	no	New class
Trident II (SUB)	Navy	Ship	no	New class
UAV	Navy	Other	no	New development
UGM-133A (Trident II)	Navy	Missile	no	New development
UGM-96A (Trident I)	Navy	Missile	no	New development
UHF Follow-on	Navy	Space	no	New generation communication sat.
V-22 (Osprey)	Navy	Helo	no	New type
VAST	Navy	Electronic	no	New development
JTUAV	DoD	Other	no	
JTUAV (Hunter)	DoD	Other	no	Based on IAI Hunter
Patriot PAC-3	DoD	Missile	yes	Upgrade to Patriot air defense system
SDS/GPALS	DoD	Other	no	No precedent

Appendix F
DATABASE FILES

A pocket in the back cover contains a disk with several files on it. These files include the two type of analysis files that are part of the DSCPD: the PEA file and the time trend files. The database files are in Microsoft Excel 5.0 format. The disk included here is formatted for a DOS system.

The following files are included on the disk:

PEA94.xls—Point Estimate Analysis file.

TTPE--94.xls—calendar-year-based time trend file for PE baseline.

TTPE2-94.xls—time trend file for PE baseline, based on years past the EMD start.

TTDE--94.xls—calendar-year-based time trend file for DE baseline.

TTDE2-94.xls—time trend file for DE baseline, based on years past the EMD start.

TTPDE-94.xls—calendar-year-based time trend file for PdE baseline.

*TTPDE294.*xls—time trend file for PdE baseline, based on years past the EMD start.

The PEA file is structured as Appendix A. An "N/A" in a cell indicates that all or part of the information needed to determine a numeric value was not available

There are two time trend files for each baseline type (PE, DE, and PdE). The first corresponds to calendar year, the second aligns the cost growth factors for each program to years past EMD start. The two types of files support different analyses depending on whether the focus is on calendar year or program maturity. The time trend files include program name and service designations. Cost growth factors are included based on data in the first and last SAR (or December 1994 SAR), and all intermediate December SARs.

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